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The Information of Historical Cost Earnings Relative to Supplemental Reserve-Based Accounting Data in the Extractive Petroleum Industry

B. Michael Doran, Daniel W. Collins, and Dan S. Dhaliwal

ABSTRACT: The perceived limitations of historical cost net income for assessing the relative performance of oil and gas firms led the SEC and FASB to issue a series of pronouncements requiring disclosure of current value reserve-based information to supplement the information contained in the primary financial statements. This study examines whether historical cost earnings of oil and gas companies possess information in the sense of explaining cross-sectional differences in firm security returns. Additionally, we examine whether various Reserve Recognition Accounting-based measures possess incremental information relative to historical cost earnings measurements. The results indicate that for the sample period 1979–1981, historical cost earnings as well as reserve-based measures constructed from RRA data contain information relevant to valuing oil and gas firms. However, these results deteriorate for the sample period 1982–1984 where reserve-based measures are constructed from SFAS No. 69 data. The weaker relations in the latter period are consistent with the findings of Miller and Upton [1985b] and Magliolo [1986] and are attributed to the relative stability of oil prices during this time frame which results in a lower "signal-to-noise" ratio for the various reserve-based measurements.

THIS study examines whether changes in the historical cost earnings of oil and gas companies possess information in the sense of explaining cross-sectional differences in firm security returns. We also assess whether three Reserve Recognition Accounting (RRA)-based measures possess incremental information relative to historical cost earnings measurements. The three reserve-based measures examined are constructed from disclosures called for in SEC Accounting Series Release (ASR) Nos. 253 [1978] and 269 [1979] and consist of: (1) the change in the present value

The authors express their appreciation to Vic Bernard and Johannes Ledolter for helpful discussions regarding various econometric issues that arose in this paper and to anonymous reviewers for their comments. They also thank Jaeuk Khil for his assistance in the data-gathering process.

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of estimated future oil and gas net[1] revenues resulting from new discoveries and extension of proved reserves[2] (*PVDIS*); (2) the change in the present value of estimated future oil and gas net revenues from proved reserves due to revisions in price, quantity, and "other" estimates (*PVRPQ*); and (3) reserve recognition accounting earnings (*RRANI*). In addition, three reserve-based measures constructed from disclosures required by SFAS No. 69 [1982] are examined. These measures consist of: (1) *PVDIS* as previously defined;[3] (2) the change in the present value of future net revenues due to revisions in price and quantity estimates (*PVRPQ*);[4] and (3) the total change for the year in the present value of future net revenues excluding changes from sales and purchases of reserves (*PVTCH*).[5]

The primary motivation for this study is to empirically test the validity of conclusions reached in major policy statements on oil and gas accounting issued by the SEC and Financial Accounting Standards Board (FASB) regarding the relative usefulness to investors of historical cost vs. present value reserve-based measures for valuing equity securities. For example in ASR No. 253, the SEC concluded [*SEC Docket*, September 12, 1978, p. 929]:

> . . . (1) traditional accounting methods fail to provide sufficient information on financial position and operating results of oil and gas producers; (2) information supplemental to primary financial statements is required to permit comparison of companies engaged in oil and gas producing activities; (3) development of an accounting method based on a valuation of proved oil and gas reserves *would provide significant useful information*, and steps should be taken to develop such a method; . . . [Emphasis added]

As an initial attempt to provide additional information about the operating results of oil and gas producers, the SEC adopted rules requiring supplementary disclosure of (1) quantities of proved oil and gas reserves and new discoveries for the period; (2) the present value of future net revenues relating to proved reserves and changes thereto; and (3) a statement of earnings based on the value of proved reserves as prescribed by RRA.[6] Such disclosures were first required in 10-K filings for fiscal years ending after December 25, 1979, and were extended to annual stockholder reports beginning December 25, 1980. In adopting these disclosure requirements, the SEC asserted that the measurements would provide significant relevant information for assessing the future cash flow prospects of oil and gas producing firms over and above that provided by traditional historical cost-based financial statement disclosures.

Following the issuance of ASR Nos. 253 and 269, the SEC proposals were severely criticized. Oil and gas producers, representatives from public accounting and analysts from the oil and gas industry argued that RRA disclosures were based on highly subjective and inherently imprecise estimates of (1) proved reserve quantities; (2) the timing of future production; (3) future production costs; and (4) future revenues. Accordingly, the RRA disclosures were considered to be unreliable and plagued with such severe measurement problems to be of little value to financial statement users interested in assessing the relative future cash flows of oil and gas firms.[7]

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[1] "Net" means net of related future development and production costs.

[2] Additions to proved reserves result from (a) extension of the proved acreage of previously discovered (old) reservoirs through additional drilling in periods subsequent to discovery, and (b) discovery of new fields with proved reserves or of new reservoirs of proved reserves in old fields.

[3] *PVDIS* is computed on a before-tax basis under ASR No. 269 and SFAS No. 69.

[4] Like *PVDIS*, *PVRPQ* is computed on a before-tax basis. So-called "other" revisions are omitted from the *PVRPQ* measure under SFAS No. 69.

[5] SFAS No. 69 does not require the disclosure of a reserve-based measure of earnings. The total change in the net present value of future revenues excluding sales and purchases of reserves in place, however, roughly approximates the RRA earnings measure previously required by the SEC in ASR Nos. 253 and 269.

[6] For details concerning how these various measures were to be determined, see ASR Nos. 253 and 269.

The concerns expressed about the reliability of RRA disclosures prompted the SEC to reconsider its initial position regarding the usefulness of RRA vs. historical cost measures. In February 1981, the SEC issued ASR No. 289 stating that because of the inherent uncertainty of recoverable quantities of proved reserves, it no longer considered the RRA method a viable alternative to historical cost-based accounting methods for use in the *primary* financial statements. However, the Commission did reassert its commitment to *supplemental* value-based disclosures of oil and gas reserves and urged the FASB to require such value-based supplementary disclosures. It is important to note that, although the Commission expressed a strong commitment to value-based disclosures, it stopped short of supporting disclosure of RRA earnings because of the many inherent measurement problems.

In November 1982, the FASB issued SFAS No. 69, *Disclosures about Oil and Gas Producing Activities.* In issuing this statement, the FASB expressed many of the same concerns voiced earlier by the SEC regarding the usefulness of historical cost-based earnings, while reaffirming the usefulness of many of the same reserve quantity and reserve value-based disclosures as were previously called for in ASR Nos. 253 and 269. One notable exception was that an RRA measure of earnings was *not* required. The Board stated that it rejected this measure of earnings because of the inherent subjectivity of many of the underlying estimates and because it did not fit any known concept of income.

I. TESTABLE IMPLICATIONS OF POLICY POSITIONS

Several empirically testable implications arise out of the conclusions expressed by the Commission in ASR Nos. 253, 269, and 289 and by the FASB in SFAS No. 69. Empirical evidence by Ball and Brown [1968], Beaver, Clarke, and Wright [1979], and Beaver, Griffin, and Landsman [1982] demonstrate a strong positive association between the sign and magnitude of changes in historical cost earnings and abnormal security returns measured over the same time period. These results, based on a broad cross-section of firms and time periods, suggest that changes in historical cost earnings possess information in the sense that such changes are systematically associated with revisions in market agents' assessments of firms' future cash flows as revealed in security price changes. The conclusions reached by the SEC and FASB regarding the limitations of historical cost earnings measures for firms in the oil and gas industry are at variance with these findings. If, in fact, the Commission and Board's concerns are valid, then one would expect to find little or no association between yearly changes in historical cost earnings and the abnormal security returns of oil and gas firms measured over the same period.

It should be noted that while both production and refining firms in the oil and gas industry are required to disclose the RRA and SFAS No. 69 data, the arguments advanced by the SEC and FASB regarding the relative usefulness of historical cost earnings *vis-a-vis* RRA measures of performance relate primarily to the producing firms. Therefore, changes in the historical cost earnings of oil and gas producing firms relative to those of refining firms are expected to exhibit lower association with abnormal security returns.

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[7] See Connor [1979], Kolbenschlag [1979], and Adkerson [1979] for further discussion of alleged problems and limitations of RRA disclosures.

Conversely, if reserve-based data required under ASR No. 269 and SFAS No. 69 capture events or factors relevant to assessing future cash flows which are not reflected in the historical cost earnings of oil and gas producing firms, one would expect reserve-based measures to exhibit significant levels of association with firm security returns after accounting for the informational effects of historical cost earnings. Given that oil and gas exploration and production constitute a smaller fraction of the overall activities of the refining firms, the reserve measures for these firms, relative to those of producing firms, are likely to exhibit lower associations with security returns. Moreover, the position taken by the SEC in ASR No. 289 and by the FASB in SFAS No. 69 suggests a further test of the relative usefulness or information in measures based on changes in the present value of future net revenues of proved reserves due to discoveries and revisions in price and quantity estimates (i.e., *PVDIS* and *PVRPQ*) vs. RRA net income (*RRANI*). Specifically, the decision by the SEC and FASB *not* to require disclosure of RRA net income while continuing the disclosure of *PVDIS* and *PVRPQ* information suggests that *RRANI* does not contain significant incremental information after considering the information in *HCNI* and these other reserve-based measures.

II. Method, Measures, and Econometric Issues

Method

To assess the relative usefulness of historical cost vs. the reserve-based measures, we use a cross-sectional regression framework and a method similar to that used by Beaver, Griffin, and Landsman [1982] to assess the incremental information in replacement cost earnings *vis-a-vis* historical cost earnings. The incremental information in the three measures constructed from disclosures mandated by ASR Nos. 253 and 269 (i.e., the ASR No. 269 or Model (1) measures) is assessed for years 1979, 1980, and 1981. The incremental information conveyed by the three measures constructed from disclosures mandated by SFAS No. 69 (i.e., the SFAS No. 69 or Model (2) measures) is assessed for years 1982, 1983, and 1984.[8] Formally, the incremental information models we test can be written as follows:

ASR No. 269 regressions:

$$CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81 +\beta_1\Delta HCNI_{iT} +\beta_2 PVDIS_{iT}+\epsilon_{iT} \tag{1a}$$

$$CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81 +\beta_1\Delta HCNI_{iT} +\beta_3 PVRPQ_{iT}+\epsilon_{iT} \tag{1b}$$

$$CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81 +\beta_1\Delta HCNI_{iT} +\beta_4 RRANI_{iT}+\epsilon_{iT} \tag{1c}$$

SFAS No. 69 regressions:

$$CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84 +\beta_1\Delta HCNI_{iT} +\beta_2 PVDIS_{iT}+\epsilon_{iT} \tag{2a}$$

$$CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84 +\beta_1\Delta HCNI_{iT} +\beta_3 PVRPQ_{iT}+\epsilon_{iT} \tag{2b}$$

---

[8] Although a few firms provided SFAS No. 69 disclosures in their 1981 reports, the majority of oil and gas firms began in 1982.

$$CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84 +\beta_1 \Delta HCNI_{iT} +\beta_5 PVTCH_{iT}+\epsilon_{iT} \qquad (2c)$$

where

CAR_{iT} = cumulative abnormal security return for firm i in year T constructed as the sum of 12 monthly market model forecast errors. The slope and intercept parameters for the market model were estimated by regressing individual security returns on the value weighted market index over a 72-month period ending the month prior to the beginning of the accumulation period. The accumulation period coincides with the firm's fiscal year (in this sample, January ($t=1$) through December ($t=12$)),

$YD80$ to $YD84$ = year effects indicator variables which equal one when observations are from the year indicated and 0 otherwise,

$\Delta HCNI_{iT}$ = deflated change in historical cost net income from continuing operations for firm i in year T: (i.e., $(HCNI_{iT}-HCNI_{iT-1})/MKTVAL_{iT}$),

$PVDIS_{iT}$ = deflated present value of future net revenues due to new discoveries and extensions of proved reserves for firm i in period T (i.e., $PVDIS_{iT}/MKTVAL_{iT}$),

$PVRPQ_{iT}$ = deflated present value of future net revenues due to revisions in price, quantity and, for the ASR No. 269 regressions only, "Other" estimates for firm i in period T: (i.e., $PVRPQ_{iT}/MKTVAL_{iT}$),

$RRANI_{iT}$ = deflated RRA net income for firm i in period T: (i.e., $RRANI_{iT}/MKTVAL_{iT}$),

$PVTCH_{iT}$ = total change in present value of future net revenues excluding changes resulting from sales and purchases of reserves for firm i in period T deflated by beginning of year market value of common stock: (i.e., $PVTCH_{iT}/MKTVAL_{iT}$),

$MKTVAL_{iT}$ = market value of the common stock of firm i at the beginning of year T:

α_0 = estimated intercept,

α_1 to α_4 = the estimated coefficients for the year effects indicator variables,

β_1 to β_5 = the estimated regression coefficients for the variables specified above,

ϵ_{iT} = normally distributed error term in year T,

T = year: 1979, 1980, 1981, 1982, 1983, or 1984.

Our specification of the relation between security returns and the various accounting variables in equations (1a–1c) and (2a–2c) subsumes a valuation process wherein prices are a function of certainty equivalent (risk-adjusted) expected future cash flows. The annual abnormal returns (*CAR*s) are a measure of the relative change in investor expectations regarding firms' future cash flows that have occurred over that time frame. The various accounting measures are viewed as potentially relevant signals about events occurring during the year that affect investors' future cash flow expectations.

The use of the deflated change in *HCNI* assumes that the market expectation regarding this variable is approximated by a random walk model. This model has been found to closely approximate the behavior of annual *HCNI*, and has been widely supported in previous return/earnings association studies.[9] Effectively, this model assumes that any change in the current period's earnings is viewed as permanent in nature, and causes investors to revise their expectations of all future periods' earnings (and cash flows) by a like amount.

The various RRA measures are purported to be direct measures of changes in future cash flows (discounted to the present) resulting from such things as new discoveries, changes in oil and gas prices, and revisions in previous reserve estimates. Thus, it appears inappropriate to use a random walk expectations model for these variables. We choose, instead, to merely deflate these changes in present value by the beginning market value of equity. If the RRA measures are reliably measuring relevant changes in the present value of future net revenues, as is purported, then they should approximate changes in the present value of future cash flows. When scaled by beginning of period market value of equity, we expect these measures to be directly related to the period's realized security returns.

It should be noted that our specification of the RRA measures in equations (1a–1c) and (2a–2c) is consistent with that used by Magliolo [1986] in his income associated tests related to the Hotelling Valuation Principle. However, there are several important distinctions between his tests and ours. First, Magliolo considers only RRA measures and does not test their incremental information relative to *HCNI*. Second, his RRA income measure differs from ours in that he uses the interest adjusted change in the *undiscounted* future net revenues.[10] Thirdly, Magliolo scales his RRA measures by the market value of equity plus the beginning of the year book value of debt. Finally, the dependent variable in Magliolo's cross-sectional income tests is the change in the market value of oil and gas properties which is proxied by the market value of equity plus the book value of debt minus the book value of non-oil and gas assets. Because of the differences noted above, our analysis can be viewed as different from, yet complementary to, Magliolo's analysis.

Variable Measures

The three RRA measures (i.e., *PVDIS, PVRPQ,* and *RRANI*) are constructed from disclosures included in the RRA earnings summary required in 1979 through 1981 10-K and/or annual reports by the SEC in ASR No. 269. The SFAS No. 69 measures (i.e., *PVDIS, PVRPQ,* and *PVTCH*) are constructed from supplementary financial statement disclosures required by the FASB since 1982.

The *PVDIS* variable is a principal component of the RRA earnings summary required by ASR No. 269, and SFAS No. 69 continued the mandated disclosure of this variable. It represents the present value of future net revenues (discounted at ten percent) from proved oil and gas reserves added during the year as a result of new discoveries.[11]

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[9] See, for example, Ball and Watts [1972] and Foster [1986, chap. 7] on the time-series properties of annual earnings and Ball and Brown [1968] and Rayburn [1986] on the association between random walk earnings forecast errors and security returns.

[10] Magliolo [1986] also estimates the effects of price changes separately from quantity and other changes while we combine these effects in one variable, *PVRPQ*.

[11] An anonymous reviewer expressed concern regarding the formulation of the discovery variable, since it gives no recognition to amounts spent on exploration. To assess the sensitivity of results to the omission of exploration cost from the formulation of the discovery variable, we assessed the information in an alternative formulation of this variable by subtracting amounts spent on exploration from the present value of new discoveries. This variable was found to be highly correlated (i.e., p of greater than .9) with the discovery variable as originally formulated. Additionally, regression results

Both the SEC, in ASR Nos. 253 and 269, and the FASB, in SFAS No. 69, indicated that the discovery of new oil and gas reserves is a significant event affecting the future cash flow prospects of oil and gas producing companies. To the extent that *PVDIS* reliably measures unexpected changes in future cash flows resulting from current period discoveries and a firm's ability to find reserves, we would expect this measure to be positively associated with contemporaneous abnormal security returns.

The *PVRPQ* variable represents changes in the value of reserves proved in prior periods resulting from revisions in price, production costs, quantity, and other estimates. This variable is a major component of *RRANI* and is, in most instances, of substantially larger magnitude than *PVDIS.* To the extent that price or quantity changes reliably signal changes in future cash flows, we expect *PVRPQ* to exhibit positive association with firms' *CAR*s.

RRANI is the bottom line income number reported on the RRA earnings summary required by ASR No. 269. The SEC initially maintained that this measure of earnings, which recognizes the revenues and expenses associated with oil and gas production in the period of discovery rather than the period of sale, was a more relevant and meaningful measure of performance for valuation purposes than was *HCNI.* If this assertion is true, we would anticipate that *RRANI* should be positively associated with *CAR*s.

Note that the *RRANI* figure includes *PVDIS* and *PVRPQ* as sub-components in its determination. In addition, *RRANI* includes three other major items: (1) an amount for the accretion of discount that reflects the change in the present value of net revenues resulting simply from the passage of time; (2) the finding costs (lease acquisition and exploration expenditures) for the reserves added in the current year; and (3) a provision for income taxes calculated by multiplying current taxes times the before-tax RRA income figure. The major reason for testing the incremental information in both sub-components (*PVDIS* and *PVRPQ*) as well as the *RRANI* figure is to allow for the possibility of differential noise or garbling in the various figures. That is, many claimed that the various components of *RRANI* were subject to varying degrees of subjectivity and imprecision raising serious doubts as to whether these figures could be relied on as indicators of relative performance. By testing the incremental information of not only the composite *RRANI* figure, but also its major sub-components, we hope to shed some light on this issue.

SFAS No. 69 combined the RRA income statement and changes statement into a single statement entitled "Changes in Standardized Measure of Discounted Future Cash Flow Relating to Proved Oil and Gas Reserves." This statement reconciles the present value of reserves from the beginning to the end of the year and reports similar basic line items to those reported under ASR No. 269.

PVTCH is constructed from the present value of future net revenue disclosures required by SFAS No. 69. Specifically, *PVTCH* represents the total change in the present value of future net revenues of proved reserves excluding changes resulting from sales and purchases of reserves in place. As noted previously, SFAS No. 69 discontinued mandated disclosure of the discovery-based

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for this variable were essentially the same, albeit somewhat less significant, than for *PVDIS* as measured here and are not reported in the interest of brevity.

earnings measure (i.e., *RRANI*) required by ASR No. 269. However, *PVTCH* can be thought of as an alternative discovery-based earnings measure. As with *RRANI*, *PVTCH* would be expected to exhibit significant association with *CAR*, if such changes reliably measure changes in firms' future cash flows.

Methodological and Econometric Issues

Previous studies designed to assess the incremental information in alternative accounting measurements (e.g., Beaver, Griffin, and Landsman [1982]; Beaver and Landsman [1983]; and Bublitz, Frecka, and McKeown [1985]) have been conducted in a cross-sectional regression framework utilizing ordinary least squares (OLS) estimation procedures. The nature of the present sample and research context introduces some potential econometric problems that can adversely affect the power and reliability of standard OLS testing procedures. Prior research in accounting and finance documents an inverse relation between firm size and security return variance. The wide range of firm sizes in the sample (e.g., market value of equity ranges from approximately $20 million to in excess of $25 billion) suggests the likelihood of substantial differences in the variance of CAR_{iT} across the sample firms. In the presence of heteroscedasticity, OLS estimates of the coefficients in equations (1a–1c) and (2a–2c) will be unbiased but not minimum variance estimators [Johnston, 1972, chap. 7]. In addition, the sampling variances of the parameter estimates are likely to be biased [Judge et al., 1985, chap. 5].

Another problem is that of cross-sectional dependencies in abnormal returns due to the fact that all sample firms are from the same industry. In a recent study, Bernard [1987] analyzes the potential biases in OLS estimates of the standard errors of regression coefficients in a variety of research contexts.[12] He demonstrates that there are potentially severe (downward) biases in OLS standard error estimates in cross-sectional returns studies if the analysis is based on annual return and accounting data, and there is substantial variation in residual cross correlations across firm pairs and this cross correlation is positively associated with cross correlations in regressors. In such contexts, biases in the estimated standard errors of coefficient estimates from OLS cross-sectional regressions are potentially large enough to lead to incorrect assessments regarding the presence of incremental information.

Due to the fact that the ASR No. 269 and SFAS No. 69 reserve data are available for only a few years, there are insufficient data to directly estimate the residual variance/covariance structure in regression models (1a–1c) and (2a–2c). Rather, the conditional variance/covariance structure of the residuals from these cross-sectional regressions is assumed to differ by only a scalar from the variance/covariance structure of the CAR_{iT} measures.[13] Estimates of the variance/covariance structure and mean variance of the yearly CAR_{iT} measures are inferred from an examination of firms' monthly market model residual returns (e_{it}'s) over a 72-month estimation period ending the month (December) prior to the beginning (January) of year T ($T=1979$ through 1984). Given prior evidence that monthly security returns exhibit little or no serial correlation [Fama, 1976; Brown and Warner, 1980], the variance of CAR_{iT} (σ^2_{iT}) and covariance of CAR_{iT} with $CAR_{jT}(\sigma_{ijT})$ are estimated as 12 times the variance and covariance of the associated residual returns.

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[12] Bernard [1987] assesses the potential biases in OLS parameter variance estimates for a variety of special cases within two general research contexts: (1) events studies where the design matrix is a unit vector; and (2) cross-sectional returns studies in which stock return metrics are regressed on a design matrix of firm specific accounting variables such as multiple unexpected earnings measures. Obviously, the latter context is more relevant here.

[13] Bernard [1987] notes that such an assumption may hold approximately in studies where the accounting regressors explain only a small portion of the dependent variable's total variance. In the current study this is clearly not the case as the regression results indicate adjusted R^2 ranging as high as .60. Thus, our estimate of the variance/covariance structure is likely to be biased upward and likely results in an *overstatement* of the true but unknown effects of cross-sectional dependencies in the sample data.

An examination of the monthly residual return variances (not reported here) of the sample firms suggests that the OLS assumption of constant variance of returns is clearly violated in each of the six estimation periods. Firms in the highest decile with regard to residual return variance exhibit variances that are approximately six times greater than those of firms in the lowest decile.

It is also clear that there is positive cross-sectional correlation in the monthly market model residual returns of the sample firms. In general, more than 90 percent of the pairwise correlations are positive in each of the six estimation periods, with the average being around .20 in each period. Although the average degree of cross correlation in the residual returns is high, it is difficult to assess *ex ante*, the potential severity of bias in OLS standard error estimates of slope coefficients in a cross-sectional returns study. Bernard [1987] notes that the bias depends not only on the residual cross correlations, but how much they vary with regressor cross correlations, and how they interact with residual heteroscedasticity.

Clearly, the sample and research setting exhibits characteristics noted above that can lead to biases in conventional OLS test results conducted in a cross-sectional regression framework. Accordingly, in addition to standard OLS test procedures, we adjust the OLS test procedures in an attempt to deal with the unequal variance and positive cross correlation problems noted.

Alternative estimation procedures such as weighted least squares (WLS) and generalized least squares (GLS) that are typically used in settings of this type have limitations. One disadvantage that they share, for this study at least, is that the parameters of the variance/covariance matrix of each test period must be estimated. This introduces additional sampling variation (inefficiency) into the estimation of the coefficients. The amount of sampling error in the covariance matrix can be quite large, particularly if the ratio of the number of observations to the number of parameter estimates is small. In the present study, the number of months in the estimation period (t) is 72 and the number of firms for which requisite data are available in years 1979 through 1984 (N) varies from 44 to 60. This means that between 3,168 and 4,320 monthly returns ($t\times N$) are available to estimate between 990 and 1,830 parameters in the full variance/covariance matrix ($N(N+1)/2$). With only 3.2 to 2.4 observations per parameter estimated ($(t\times N)/(N(N+1)/2)$), the potential for introducing sampling error in the estimated variance/covariance matrices would appear to be quite large. To minimize the inefficiencies and potential biases introduced by applying full GLS estimation, we instead use OLS to estimate the regression model parameters and use the estimate of the variance/covariance structure to adjust the OLS standard error estimates for each of the coefficients in equations (1a–1c) and (2a–2c).

The estimate of the variance/covariance matrix, C_T, for each year T is estimated as $12^{*}\mathrm{cov}(e_{it},e_{jt})/\mathrm{Trace}\,\{\mathrm{cov}(e_{it},e_{jt})\}$ for all i and j from 1 to N and $t=1$ to 72.[14] The variance/covariance matrix for the ASR No. 269 (SFAS No. 69) regressions is formed by constructing a block diagonal matrix C_B from the relevant C_T matrices ($T=1979$, 1980, and 1981 for the ASR No. 269 regressions and $T=1982$, 1983, and 1984 for the SFAS No. 69 regressions). The estimated variance/covariance structure, $\hat{C}_B$, is used to adjust or correct the OLS standard error estimates of the regression coefficients of equations (1a–1c) and (2a–2c) from the following formula [Judge et al., 1985, chap. 5, sects. 3.3 and 5.1; and Bernard, 1987]:

$$\text{Corrected } s_k = \{\sigma^{2*}[(X'X)^{-1}X'\hat{C}_B X(X'X)^{-1}]_{kk}\}^{1/2}$$

where

Corrected s_k = the corrected standard error estimate of the k^{th} coefficient of the regression model,

σ^2 = OLS estimate of the residual variance (mean square error/k),

X = ($N\times k$) design matrix of the independent variables included in the regression model including the intercept,

$\hat{C}_B$ = ($N\times N$) matrix of the estimated variance/covariance structure of the error metric (ϵ_i) for the regression model in either the RRA or SFAS No. 69 test period,

k = number of independent variables included in the regression model including the intercept (e.g., $k=5$ for models (1a–1c) and (2a–2c)),

N = number of firms included in the cross-sectional regression (e.g., 85 production firm observations and 76 refiner firm observations for the ASR No. 269 regressions in Tables 5 and 6, respectively).

The corrected standard error estimates can then be used to estimate the true but unknown significance level of the associated coefficients (e.g., a t-statistic is calculated by dividing the OLS coefficient estimate by the corrected OLS standard error). It is also possible to calculate the corrected probability of the F-statistic associated with overall regression based on the corrected standard error estimates. The regressions reported subsequently in Tables 5 through 8 suggest there is substantial bias in the OLS regression estimates of the standard errors of the intercept and year indicators, but very little bias in the standard error estimates of the other regression coefficients. The lack of bias in the estimated standard errors of the slope coefficients is attributed to the relatively low dispersion in residual cross correlations across firm pairs in the oil and gas industry coupled with low interactions between residual cross correlations and regressor cross correlations. Note that the same conclusion does not apply to standard error estimates of the intercepts, or to event study contexts such as those reviewed by Collins and Dent [1984] (see, also, formula for bias in Bernard [1987, Table 2]).

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[14] The e_{it}'s are obtained from the market model regressions from the estimation period. Bold face type is used to denote vectors and matrices.

III. Empirical Results

Sample Selection and Data Sources

The sample was initially drawn from firms classified on the COMPUSTAT Annual Industrial File with a four-digit Standard Industry Classification Code (SIC) of either 1311 (crude petroleum and natural gas) or 2911 (petroleum refining). To control for cross-temporal differences in security market and industry factors (e.g., inflationary expectations and oil and gas prices), only firms with a December 31 fiscal year-end are included and separate regressions are estimated for the production and refiner firms. Requisite reserve data were obtained from 10-K and annual reports, and security returns were obtained from the monthly CRSP returns tape and the COMPUSTAT PDE tape. Firms with incomplete reserve or returns data were excluded from the cross-sectional regressions. This resulted in a final sample for the ASR No. 269 RRA regressions of 85 observations of production firms (22 in 1979, 32 in 1980, and 31 in 1981), and 76 observations of refining firms (22 in 1979, 28 in 1980, and 28 in 1981). For the SFAS No. 69 regressions, the sample consisted of 88 observations for the producing firms (32 in 1982, 28 in 1983, and 28 in 1984), and 83 observations for the refining firms (27 in 1982, 28 in 1983, and 28 in 1984).

Preliminary Data Analysis

Summary statistics for the variables included in the ASR No. 269 cross-sectional regression models (1a–1c) are reported in Table 1. Separate statistics for production and refining firms are reported in panels A and B, respectively. The most striking feature of these statistics is the dramatic difference in the general trend of security prices over the three years comprising the ASR No. 269 test period. Average *CAR* measures for production firms for 1979, 1980, and 1981 are 60 percent, minus one percent, and −44 percent, respectively. The corresponding figures for the refining firms are 28 percent, minus one percent, and −26 percent. In large part, these differences can be attributed to the corresponding changes that took place in oil prices over these years which are discussed in greater detail below. These results indicate that our tests of the information content of $\Delta HCNI$, *PVDIS*, *PVRPQ*, and *RRANI* should be made after controlling for differences in the average level of returns for the three years in the test period. This is accomplished by including year effects indicator variables (*YD*80 and *YD*81) as noted earlier.

Correlations between *CAR*, $\Delta HCNI$, *PVDIS*, *PVRPQ*, and *RRANI* for the ASR No. 269 period are reported separately for production and refining firms in panels A and B of Table 2, respectively. For production as well as refining firms, $\Delta HCNI$ and the three RRA-based measures are significantly correlated with *CAR* ($p<.01$). However, the three RRA-based measures are significantly correlated ($p<.02$) with $\Delta HCNI$ so that they may not contain incremental information over that contained in traditional historical cost earnings data.

A comparison of correlations for the production and refining firms indicates that $\Delta HCNI$ has a higher correlation with *CAR* for refining firms, whereas RRA-based measures have higher correlations with *CAR* for production firms. Furthermore, the RRA-based measures have higher correlations with $\Delta HCNI$ for refining firms. These comparative results suggest that historical cost earnings data are less informative for production firms than for refining firms, whereas the RRA-based measures are more infor-

TABLE 1

CROSS-SECTIONAL SUMMARY STATISTICS FOR DEPENDENT AND INDEPENDENT VARIABLES USED IN RRA REGRESSIONS—ASR NO. 269 PERIOD[1]

	1979	*1980*	*1981*	*Pooled*
	Mean/Std. Dev.	*Mean/Std. Dev.*	*Mean/Std. Dev.*	*Mean/Std. Dev.*
PANEL A: PRODUCTION FIRMS				
Variables				
Dependent				
CAR_{iT}	.60/.31	−.01/.41	−.44/.35	−.01/.55
Independent				
$\Delta HCNI_{iT}$	.07/.10	.02/.03	.00/.02	.03/.06
$PVDIS_{iT}$	.36/.40	.24/.21	.10/.10	.22/.26
$PVRPQ_{iT}$	.56/.52	.22/.22	.06/.22	.25/.37
$RRANI_{iT}$	.49/.40	.18/.13	.05/.12	.22/.28
$MKTVAL_{iT}$	179/224	436/656	891/1107	535/832
$n=$	22	32	31	85
PANEL B: REFINER FIRMS				
Variables				
Dependent				
CAR_{iT}	.28/.18	−.01/.41	−.26/.21	−.01/.36
Independent				
$\Delta HCNI_{iT}$	.08/.05	.03/.04	−.01/.04	.03/.06
$PVDIS_{iT}$	.17/.13	.12/.08	.10/.06	.12/.10
$PVRPQ_{iT}$	1.08/.69	.52/.51	.00/.18	.51/.65
$RRANI_{iT}$	.53/.29	.22/.17	.04/.06	.25/.27
$MKTVAL_{iT}$	4232/4764	5249/5305	7962/8626	5882/6614
$n=$	22	28	26	76

[1] Legend

CAR_{iT} = cumulative abnormal market model residual security returns for firm i in year T.

$\Delta HCNI_{iT}$ = deflated change in historical cost net income for firm i in year T $[(HCNI_{iT}-HCNI_{iT-1})/MKTVAL_{iT}]$.

$PVDIS_{iT}$ = deflated change in the present value of future net revenues for firm i in year T due to discovery and extension of proved reserves $[PVDIS_{iT}/MKTVAL_{iT}]$.

$PVRPQ_{iT}$ = deflated change in the present value of future net revenues for firm i in year T due to revisions in price, quantity, and other estimates $[PVRPQ_{iT}/MKTVAL_{iT}]$.

$RRANI_{iT}$ = deflated reserve recognition accounting income for firm i in year T $[RRANI_{iT}/MKTVAL_{iT}]$.

$MKTVAL_{iT}$ = market value of common stock for firm i at the beginning of year T in millions of dollars.

mative for producing firms than they are for refining firms. The fact that the RRA-based measures have higher correlations with $\Delta HCNI$ for the refining firms *vis-a-vis* producing firms suggests that the *incremental* information in the RRA measures relative to HC earnings is likely to be less for the refining firms than for the producing firms. These results are consistent with the earlier discussion suggesting that in comparison to refining firms, the historical cost earnings data of producing firms are expected to be less informative, whereas the RRA-based data are expected to be more informative.

TABLE 2

CORRELATION MATRIX FOR CAR_{iT} AND ACCOUNTING VARIABLES USED IN RRA REGRESSIONS— ASR NO. 269 PERIOD[1]

PRODUCT-MOMENT CORRELATIONS (SIGNIFICANCE LEVELS)

	$\Delta HCNI_{iT}$	$PVDIS_{iT}$	$PVRPQ_{iT}$	$RRANI_{iT}$
PANEL A: PRODUCTION FIRMS ($n=85$ pooled observations)				
CAR_{iT}	.46 (<.01)	.43 (<.01)	.57 (<.01)	.66 (<.01)
$\Delta HCNI_{iT}$	—	.26 (.02)	.34 (<.01)	.43 (<.01)
$PVDIS_{iT}$	—	—	.10 (.36)	.38 (<.01)
$PVRPQ_{iT}$	—	—	—	.82 (<.01)
PANEL B: REFINER FIRMS ($n=76$ pooled observations)				
CAR_{iT}	.66 (<.01)	.35 (<.01)	.56 (<.01)	.58 (<.01)
$\Delta HCNI_{iT}$	—	.31 (<.01)	.64 (<.01)	.69 (<.01)
$PVDIS_{iT}$	—	—	.24 (.04)	.35 (<.01)
$PVRPQ_{iT}$	—	—	—	.89 (<.01)

[1] Legend (see Table 1)

Summary statistics for the variables used in SFAS No. 69 cross-sectional regression models (2a–2c) are reported in panels A and B of Table 3 for production and refining firms, respectively. In comparison to the time period covered by the ASR No. 269 data analysis, the mean annual *CAR* during the SFAS No. 69 period is lower (especially in 1982), and exhibits less year to year volatility. This finding is consistent with the decline in oil prices in the early part of the SFAS No. 69 period followed by relative price stability as reflected in Figure 1. This figure plots the average monthly domestic wellhead price of crude oil ($/Barrel) from January 1979 to December 1984. The lower level and volatility of oil prices and the flatter trend in prices for the SFAS No. 69 period *vis-a-vis* the ASR No. 269 period are readily apparent.

The pattern of oil prices over the entire six-year sample period also is helpful in explaining some rather dramatic year-to-year differences in mean values of several of the accounting measures reported in Tables 1 and 3. For example, note that the average change in the present value of net revenues resulting from price and quantity revisions (*PVRPQ*) is positive throughout the ASR No. 269 period (particularly in 1979 and 1980),

TABLE 3
CROSS-SECTIONAL SUMMARY STATISTICS FOR DEPENDENT AND INDEPENDENT VARIABLES USED IN SFAS NO. 69 REGRESSIONS[1]

	1982	*1983*	*1984*	*Pooled*
	Mean/Std. Dev.	*Mean/Std. Dev.*	*Mean/Std. Dev.*	*Mean/Std. Dev.*
PANEL A: PRODUCTION FIRMS				
Variables				
Dependent				
CAR_{iT}	−.84/.55	−.16/.36	−.35/.46	−.47/.55
Independent				
$\Delta HCNI_{iT}$	−.02/.09	−.05/.13	−.01/.15	−.03/.13
$PVDIS_{iT}$	.16/.11	.20/.14	.21/.21	.19/.16
$PVRPQ_{iT}$	−.01/.27	−.21/.36	−.05/.16	−.09/.29
$PVTCH_{iT}$	.27/.23	.24/.39	.36/.37	.29/.33
$MKTVAL_{iT}$	649/988	410/747	371/519	485/788
$n=$	32	28	28	88
PANEL B: REFINER FIRMS				
Variables				
Dependent				
CAR_{iT}	−.35/.21	−.00/.18	.05/.21	−.10/.27
Independent				
$\Delta HCNI_{iT}$	−.03/.04	−.02/.07	.01/.06	−.02/.06
$PVDIS_{iT}$	.13/.09	.16/.12	.15/.11	.15/.11
$PVRPQ_{iT}$	−.08/.25	−.10/.26	−.02/.20	−.07/.24
$PVTCH_{iT}$	.34/.18	.42/.24	.42/.19	.39/.21
$MKTVAL_{iT}$	6137/6252	5050/5619	5583/6866	5584/6206
$n=$	27	28	28	83

[1] Legend

$CAR_{iT}=$ cumulative abnormal market model residual security returns for firm i in year T.

$\Delta HCNI_{iT}=$ deflated change in historical cost net income for firm i in year T $[(HCNI_{iT}-HCNI_{iT-1})/MKTVAL_{iT}]$.

$PVDIS_{iT}=$ deflated change in the present value of future net revenues for firm i in year T due to discovery and extension of proved reserves $[PVDIS_{iT}/MKTVAL_{iT}]$.

$PVRPQ_{iT}=$ deflated change in the present value of future net revenues for firm i in year T due to revisions in price and quantity estimates $[PVRPQ_{iT}/MKTVAL_{iT}]$.

$PVTCH_{iT}=$ deflated change in total present value of future net revenues for firm i in year T excluding changes resulting from sales and purchases of reserves $[PVTCH_{iT}/MKTVAL_{iT}]$.

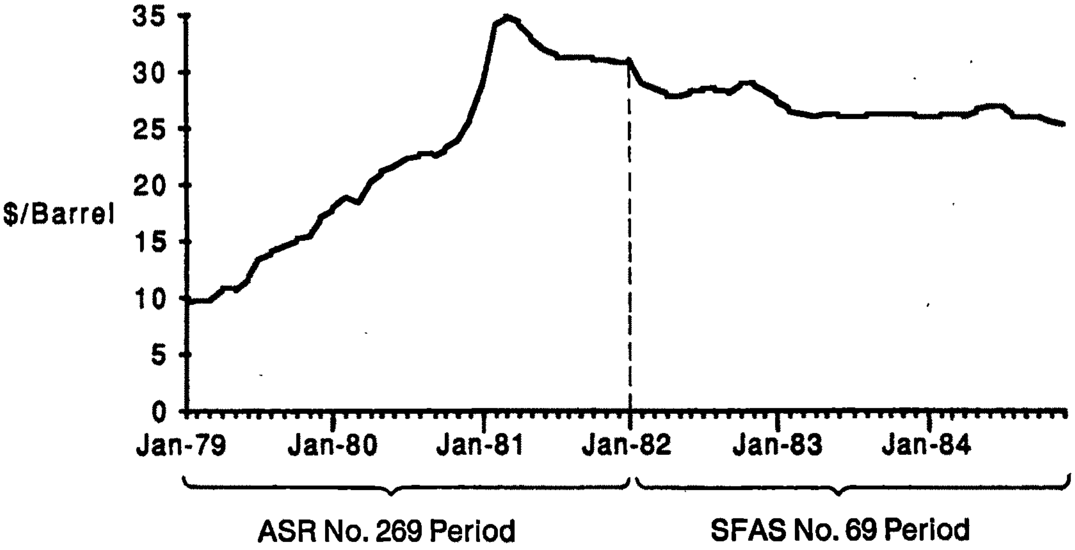
$MKTVAL_{iT}=$ market value of common stock for firm i at the beginning of year T in millions of dollars.

but consistently negative in the SFAS No. 69 period. These results are consistent with the dramatic upward movement in oil prices in the early years of the ASR No. 269 period followed by a dramatic turnaround and general weakening of prices throughout the SFAS No. 69 period. Also, the present value of new discoveries (*PVDIS*) and *RRANI* were, on average, their largest in 1979–1980 when oil prices were rapidly rising. *PVDIS* takes on its lowest values in 1981 and 1982 when oil prices suffered their biggest decline which is consistent with

FIGURE 1

CRUDE OIL PRICE

ACTUAL DOMESTIC AVERAGE PER MONTH WELLHEAD PRICE*



* Source: Monthly Energy Review, U.S. Department of Energy

exploration activity being curtailed during falling oil prices.

The somewhat weaker but relatively stable oil prices in the SFAS No. 69 period provides a possible explanation for the lower associations observed between the RRA accounting measures and *CAR*s reported in Table 4. Note that for the production firms none of the RRA measures is significantly associated with *CAR*s. For the refiner firms, only the *PVTCH* measure shows modest correlation ($\hat{\rho} = .23$) with returns. Weaker associations between reserve-based measures and changes in firm market values (returns) during the SFAS No. 69 *vis-a-vis* the ASR No. 269 period are also reported by Miller and Upton [1985b] and Magliolo [1986]. Like Miller and Upton, we are inclined to attribute the weaker associations to the relative stability of oil prices over this time frame. That is, with relative price stability there is less likely to be significant information conveyed by the RRA disclosures. This is borne out by comparing the summary (pooled) statistics for the RRA measures in Table 3 (SFAS No. 69 period) with the corresponding measures in Table 1 (ASR No. 269 period). Note that in most cases the mean values of the RRA measures are closer to zero (implying that the change in present value of future net revenues is smaller) and exhibit less cross-sectional variation in the SFAS No. 69 period vs. the ASR No. 269 period. It is also evident that there is less year-to-year variation in the RRA measures for the SFAS No. 69 period as compared to the ASR No. 269 period. Because the data are subject to measurement error, these differences in both the cross-sectional and intertemporal variation of the RRA signals are important. The lower signal-to-

TABLE 4

CORRELATION MATRIX FOR CAR_{iT} AND ACCOUNTING VARIABLES USED IN SFAS NO. 69 REGRESSIONS[1]

PRODUCT-MOMENT CORRELATIONS (SIGNIFICANCE LEVELS)

	$\Delta HCNI_{iT}$	$PVDIS_{iT}$	$PVRPQ_{iT}$	$PVTCH_{iT}$
PANEL A: PRODUCTION FIRMS ($n=88$ pooled observations)				
CAR_{iT}	.07 (.54)	.07 (.49)	.07 (.51)	.09 (.41)
$\Delta HCNI_{iT}$	—	−.04 (.73)	.19 (.07)	.17 (.12)
$PVDIS_{iT}$	—	—	−.03 (.81)	.64 (<.01)
$PVRPQ_{iT}$	—	—	—	.36 (<.01)
PANEL B: REFINER FIRMS ($n=83$ pooled observations)				
CAR_{iT}	.21 (.06)	.13 (.24)	−.02 (.87)	.23 (.04)
$\Delta HCNI_{iT}$	—	−.05 (.67)	−.03 (.77)	−.11 (.33)
$PVDIS_{iT}$	—	—	−.18 (.10)	.55 (<.01)
$PVRPQ_{iT}$	—	—	—	.07 (.51)

[1] Legend (see Table 3)

noise ratio in the SFAS No. 69 period attenuates the correlation coefficients and the slope coefficients in the multiple regression analysis (reported below) towards zero.

The correlation between *ΔHCNI* and *CAR* in the SFAS No. 69 period as reported in Table 4 is also substantially lower than during the earlier period. The correlation for the refining firms is .21 which is significant at the .05 level. However, for the production firms there is essentially no association between *ΔHCNI* and *CAR* for the same period. Unlike the case for the RRA data, the variation in the pooled *ΔHCNI* data is nearly twice as large in the SFAS No. 69 period as compared to the ASR No. 269 period for the producing firms (.13 vs. .06) and is identical for the refining firms (.06). Thus, it is difficult to attribute the weaker associations for this variable to the smaller variation in the data for the SFAS No. 69 period *vis-a-vis* the ASR No. 269 period. The weaker associations suggest that either historical cost earnings measurements contained significantly higher garbling or noise during the SFAS No. 69 period and/or that a random walk expectations model represents a poor proxy for the market's earnings expectations during these particular years. Attempts to disentangle these two effects are briefly discussed below.

IV. CROSS-SECTIONAL REGRESSION RESULTS

Production Firms in ASR No. 269 Period

Table 5 presents cross-sectional RRA regression results for production firms for the models outlined in equations (1a–1c). Model (1) includes the year indicator variables and $\Delta HCNI$ as the only explanatory variables. The year indicators are included to control for year-to-year variations in the average *CAR*s reported in the preliminary results. As such, this model is appropriate for assessing the empirical validity of statements regarding the information (or lack thereof) in historical cost earnings measurements of oil and gas companies.

The adjusted R^2 for this model is .57, which is exceptionally high compared to the findings of other studies attempting to explain cross-sectional variation in *CAR*s with changes in *HC* earnings. The $\Delta HCNI$ coefficient is positive and significant at .01 or less, even after adjusting the standard error of the estimate for potential bias (see the "Probability (corrected)" line in Table 5). Thus, relative differences in the yearly changes in historical cost earnings measurements are consistent with revisions in the market's assessment of future cash flows as revealed in the annual *CAR* measures. Moreover, the $\Delta HCNI$ measure continues to exhibit significant explanatory power ($p<.05$) after including the RRA-based measures individually (see models (1a–1c) in Table 5). This evidence is inconsistent with the SEC's claim in ASR No. 253 and No. 269 that historical cost earnings are of limited usefulness in terms of assessing the relative performance for oil and gas producing firms.

In models (1a–1c) of Table 5 we assess whether *PVDIS*, *PVRPQ*, and *RRANI* possess incremental information over historical cost earnings measures. The estimated coefficient for each of the three RRA-based measures is positive and significant at .05 or less, even after adjusting the standard errors of the estimates for potential bias (see results for models (1a–1c) of Table 5). Each of the reserve-based measures has significant explanatory power over $\Delta HCNI$. There is no clear evidence that any one reserve-based measure outperforms the others in terms of its incremental explanatory power with respect to $\Delta HCNI$. Although the adjusted R^2 is marginally higher when adding *RRANI* to the equation with $\Delta HCNI$ alone, there is no significant improvement in explanatory power when *RRANI* is added to an equation that includes $\Delta HCNI$, *PVDIS*, and *PVRPQ* (results not reported here). Overall, the results are consistent with the SEC and FASB claims that the RRA-based measures are relevant to assessing future cash flows of oil and gas producing firms.

Refining Firms in ASR No. 269 Period

RRA cross-sectional regression results for refining firms are presented in Table 6. The adjusted R^2 for model (1), which includes the year indicator variables and $\Delta HCNI$ as the only explanatory variables, is .45. As in the case for production firms, $\Delta HCNI$ is a significant ($p<.01$) explanator for *CAR*s by itself as well as after including the reserve-based measures individually (see models (1a–1c)).

As expected, a comparison of the coefficient of $\Delta HCNI$ statistics in models (1), and (1a–1c) of Table 6 with the corresponding models in Table 5 suggests that $\Delta HCNI$ possesses higher explanatory power for refining firms than for production firms. That is, the historical cost earnings data appear to be more informative in explaining future cash flow

TABLE 5
PRODUCTION FIRMS (SIC 1311)
POOLED CROSS-SECTIONAL REGRESSIONS FOR ASR NO. 269 PERIOD[1]

Regression (1):[2] $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	F-statistic	Adjusted R²	MSE
Coefficient	.50	−.55	−.94	1.61	38.54	.57	.13
Standard Error	.09	.10	.11	.70			
Probability[3]	<.01	<.01	<.01	.01	<.01		
Standard Error (corrected)	.18	.24	.25	.63			
Probability (corrected)	<.01	.03	<.01	<.01	<.01		

Regression (1a): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_2 PVDIS_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R²	MSE
Coefficient	.39	−.52	−.87	1.43	.32	31.04	.59	.12
Standard Error	.10	.10	.11	.69	.16			
Probability	<.01	<.01	<.01	.02	.02	<.01		
Standard Error (corrected)	.18	.24	.24	.63	.16			
Probability (corrected)	.03	.03	<.01	.01	.03	<.01		

Regression (1b): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_2 PVRPQ_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R²	MSE
Coefficient	.32	−.45	−.79	1.30	.34	33.53	.61	.12
Standard Error	.10	.10	.11	.68	.12			
Probability	<.01	<.01	<.01	.03	<.01	<.01		
Standard Error (corrected)	.18	.23	.23	.62	.11			
Probability (corrected)	.06	.05	<.01	.02	<.01	<.01		

Regression (1c): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_2 RRANI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R²	MSE
Coefficient	.25	−.40	−.73	1.04	.56	35.22	.62	.11
Standard Error	.11	.11	.12	.68	.17			
Probability	.02	<.01	<.01	.07	<.01	<.01		
Standard Error (corrected)	.17	.23	.23	.63	.15			
Probability (corrected)	.14	.09	<.01	.05	<.01	<.01		

[1] *YDxx* denotes a fiscal year indicator variable. Total number of observations = 85 (22 in 1979, 32 in 1980, and 31 in 1981).

[2] Dependent and independent regression variables defined in the text.

[3] Probability levels given for $\alpha(\beta)$ coefficients are based on two (one) tailed *t*-test.

prospects for the refining firms than for the producing firms.

With respect to the reserve-based measures of refining firms, results of models (1a–1c) of Table 6 indicate that these measures possess moderate incremental explanatory power. That is, these measures appear to contain a certain degree of in-

Table 6
Refining Firms (SIC 2911)
Pooled Cross-Sectional Regressions for ASR No. 269 Period[1]

Regression (1):[2] $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	F-statistic	Adjusted R^2	MSE
Coefficient	.02	−.12	−.24	3.14	21.28	.45	.07
Standard Error	.09	.09	.11	.80			
Probability[3]	.84	.20	.04	<.01	<.01		
Standard Error (corrected)	.15	.17	.20	1.08			
Probability (corrected)	.91	.53	.23	<.01	<.01		

Regression (1a): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_2 PVDIS_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R^2	MSE
Coefficient	−.05	−.10	−.22	2.91	.55	17.02	.46	.07
Standard Error	.10	.09	.11	.80	.33			
Probability	.57	.25	.05	<.01	.05	<.01		
Standard Error (corrected)	.16	.17	.20	1.07	.30			
Probability (corrected)	.73	.56	.27	<.01	.03	<.01		

Regression (1b): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_3 PVRPQ_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_3$	F-statistic	Adjusted R^2	MSE
Coefficient	−.05	−.09	−.18	2.78	.09	16.59	.45	.07
Standard Error	.10	.09	.12	.83	.07			
Probability	.62	.35	.14	<.01	.09	<.01		
Standard Error (corrected)	.15	.17	.20	1.17	.07			
Probability (corrected)	.74	.62	.38	.01	.09	<.01		

Regression (1c): $CAR_{iT}=\alpha_0+\alpha_1 YD80+\alpha_2 YD81+\beta_1 \Delta HCNI_{iT}+\beta_4 RRANI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_4$	F-statistic	Adjusted R^2	MSE
Coefficient	−.07	−.07	−.17	2.75	.22	16.47	.45	.07
Standard Error	.11	.10	.12	.85	.18			
Probability	.54	.47	.18	<.01	.11	<.01		
Standard Error (corrected)	.16	.18	.20	1.20	.20			
Probability (corrected)	.67	.69	.41	.01	.13	<.01		

[1] Total number of observations = 76 (22 in 1979, 28 in 1980, 26 in 1981).

[2] Dependent and independent regression variables defined in the text.

[3] Probability levels given for $\alpha(\beta)$ coefficients are based on two (one) tailed t-test.

formation above that contained in historical cost earnings data. However, a comparison of results of models (1a–1c) of Table 6 with the corresponding models in Table 5 indicates that the incremental information in the reserve-based measures is generally lower for refining firms than for production firms. This finding is consistent with the prior discussion suggesting that RRA data of refining firms are expected to be less informative than for production firms due to the fact that oil and gas exploration and production represent a smaller proportion of refining firms' activities.

In summary, the RRA cross-sectional regression results over the sample period 1979–1981 indicate that historical cost earnings data as well as reserve-based measures are informative in assessing the future cash flows of production as well as refining firms. Reserve-based measures appear to contain relevant valuation information in addition to that contained in historical cost earnings data. A comparison between production and refining firms indicates that historical cost earnings are more informative for refining firms *vis-a-vis* production firms, whereas the opposite is true with respect to the reserve-based measures. These comparative results are consistent with prior expectations. Overall, these findings contradict the SEC's and FASB's view that historical cost earnings data for oil and gas producing firms are of limited usefulness for assessing the cash flow prospects of these firms. On the other hand, the results support their claim that reserve-based measures provide additional useful information.

Production Firms in SFAS No. 69 Period

Cross-sectional regression results based on SFAS No. 69 data for the sample period 1982–1984 are presented in Table 7 for the production firms. In comparison to RRA data results for the period 1979–1981, the results are much weaker as would be expected from the correlations reported earlier. The adjusted R^2 is .27 for model (2) in Table 7, which includes the year effects indicator variables and $\Delta HCNI$ as the only explanators. The $\Delta HCNI$ coefficient is statistically insignificant in this model as well as models (2a–2c) in Table 7 where, in addition to $\Delta HCNI$, reserve-based measures are included individually. Thus, unlike during the 1979–1981 period, historical cost earnings data during 1982–1984 do not appear to possess information useful for assessing future cash flow prospects. These results are somewhat puzzling given the strength of the findings with respect to $\Delta HCNI$ in the ASR No. 269 period.

With respect to the reserve-based measures constructed from SFAS No. 69 data, the only variable that exhibits statistically significant incremental explanatory power is $PVRPQ$ (see model (2b)) whose coefficient is significant at the .02 level or less even after adjusting for the estimated bias in the standard error estimate. Overall, these results suggest that in comparison to the RRA results for earlier years, reserve-based measures constructed from SFAS No. 69 data appear to possess substantially less information.

Refining Firms in SFAS No. 69 Period

Cross-sectional regressions based on SFAS No. 69 data for refining firms are presented in Table 8. The overall explanatory power of models (2a–2c) in Table 8 is higher than that of the corresponding models for the production firms. As in the case of the production firms, the $\Delta HCNI$ coefficient is statistically insignificant when it is the only accounting-based variable included in the model (see model (2) of Table 8) as well as when the reserve-based measures are included individually (models (2a–2c) of Table 8). That is, historical cost earnings of refining firms for 1982–1984 appear to lack information useful for assessing future cash flow prospects. This variable does not appear significant

TABLE 7

PRODUCTION FIRMS (SIC 1311)
POOLED CROSS-SECTIONAL REGRESSIONS FOR SFAS NO. 69 PERIOD[1]

Regression (2):[2] $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	F-statistic	Adjusted R^2	MSE
Coefficient	−.83	.70	.49	.49	11.85	.27	.22
Standard Error	.08	.12	.12	.40			
Probability[3]	<.01	<.01	<.01	.11	<.01		
Standard Error (corrected)	.21	.32	.32	.40			
Probability (corrected)	<.01	.03	.13	.11	.09		

Regression (2a): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\beta_2 PVDIS_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R^2	MSE
Coefficient	−.84	.69	.49	.50	.05	8.79	.26	.22
Standard Error	.10	.12	.12	.40	.32			
Probability	<.01	<.01	<.01	.11	.44	<.01		
Standard Error (corrected)	.22	.32	.32	.40	.25			
Probability (corrected)	<.01	.03	.13	.11	.42	.17		

Regression (2b): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\beta_2 PVRPQ_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R^2	MSE
Coefficient	−.83	.77	.50	.35	.40	10.49	.30	.21
Standard Error	.08	.12	.12	.40	.18			
Probability	<.01	<.01	<.01	.19	.02	<.01		
Standard Error (corrected)	.21	.31	.31	.40	.17			
Probability (corrected)	<.01	.02	.11	.19	.01	<.01		

Regression (2c): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84-\beta_1 \Delta HCNI_{iT}+\beta_3 PVTCH_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R^2	MSE
Coefficient	−.86	.70	.48	.45	.12	8.98	.27	.22
Standard Error	.09	.12	.12	.41	.16			
Probability	<.01	<.01	<.01	.14	.23	<.01		
Standard Error (corrected)	.22	.32	.32	.41	.14			
Probability (corrected)	<.01	.03	.14	.14	.20	.13		

[1] Total number of observations = 88 (32 in 1982, 28 in 1983, and 28 in 1984).

[2] Dependent and independent regression variables defined in the text.

[3] Probability levels given for $\alpha(\beta)$ coefficients are based on one (two) tailed t-test.

in the multiple regressions but shows significant correlation with *CAR*s in Table 4 (panel B) because $\Delta HCNI$ is positively correlated with the year indicator variable. The point-biserial correlation between $\Delta HCNI$ and *YD*83 is .26 and .40 for *YD*84 (each is significant at .02 or less).

TABLE 8
REFINING FIRMS (SIC 2911)
POOLED CROSS-SECTIONAL REGRESSIONS FOR SFAS NO. 69 PERIOD[1]

Regression (2):[2] $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	F-statistic	Adjusted R²	MSE
Coefficient	−.34	.35	.39	.35	21.24	.43	.04
Standard Error	.04	.06	.06	.41			
Probability[3]	<.01	<.01	<.01	.20	<.01		
Standard Error (corrected)	.10	.15	.15	.48			
Probability (corrected)	<.01	.02	.01	.24	.02		

Regression (2a): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\beta_2 PVDIS_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_2$	F-statistic	Adjusted R²	MSE
Coefficient	−.36	.34	.38	.37	.13	15.91	.42	.04
Standard Error	.05	.06	.06	.41	.21			
Probability	<.01	<.01	<.01	.19	.27	<.01		
Standard Error (corrected)	.10	.15	.15	.48	.19			
Probability (corrected)	<.01	.02	.01	.22	.25	.04		

Regression (2b): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84+\beta_1 \Delta HCNI_{iT}+\beta_3 PVRPQ_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_3$	F-statistic	Adjusted R²	MSE
Coefficient	−.35	.35	.39	.33	−.07	15.93	.42	.04
Standard Error	.04	.06	.06	.41	.10			
Probability	<.01	<.01	<.01	.22	.25	<.01		
Standard Error (corrected)	.10	.15	.15	.47	.11			
Probability (corrected)	<.01	.02	<.01	.25	.27	.04		

Regression (2c): $CAR_{iT}=\alpha_0+\alpha_3 YD83+\alpha_4 YD84-\beta_1 \Delta HCNI_{iT}+\beta_5 PVTCH_{iT}+\epsilon_{iT}$

	$\hat{\alpha}_0$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\beta}_1$	$\hat{\beta}_5$	F-statistic	Adjusted R²	MSE
Coefficient	−.40	.33	.37	.44	.17	16.86	.44	.04
Standard Error	.05	.06	.06	.41	.11			
Probability	<.01	<.01	<.01	.14	.05	<.01		
Standard Error (corrected)	.10	.14	.15	.47	.10			
Probability (corrected)	<.01	.02	.01	.17	.04	.02		

[1] Total number of observations=83 (27 in 1982, 28 in 1983, 28 in 1984).

[2] Dependent and independent regression variables defined in the text.

[3] Probability levels given for $\alpha(\beta)$ coefficients are based on two (one) tailed t-test.

With respect to reserve-based measures constructed from SFAS No. 69 data, the only measure that exhibits modestly significant explanatory power is *PVTCH* whose coefficient is significant at the .04 level after adjusting for the bias in the standard error estimate (see model (2c) of Table 8). These results imply that during this sample period reserve-based measures of refining firms, like those of production firms, possess relatively little information.

Consistent with the preliminary findings, cross-sectional regression results suggest that historical cost earnings data as well as reserve-based measures are much less informative for the sample period 1982–1984 than they are for 1979–1981. The decline in the explanatory power of historical cost earnings is difficult to explain. As noted earlier, one possible reason is that a random walk expectations model represents a poor proxy for the markets' earnings expectations in this particular time frame. To provide some evidence on this point, we reran model (2) in Table 8 using analysts' earnings forecast errors in place of the random walk forecast errors. Analyst forecast errors were derived by comparing actual earnings with *Value Line* analysts' forecasts as of the beginning of the year. Data were available for 73 firm-years in the 1982–1984 period compared to 83 firm-years for our original sample of refiner firms.[15] Using analysts' forecasts to proxy for market earnings expectations resulted in a β_1 coefficient of 1.33 and a standard error (adjusted) of .58 which is significant at $p = .01$. Thus, this evidence suggests that the weaker associations between security returns and *HC* earnings measures in the SFAS No. 69 period can, in part, be attributed to the random walk model serving as a relatively poor proxy for the market's earnings expectations during this time frame.

The decline in the information in reserve-based measures during the later years is consistent with the findings of Miller and Upton [1985a and 1985b] and Magliolo [1986]. As noted earlier, Miller and Upton [1985b, p. 1015] attribute this decline to the fact that oil and gas prices during this period were relatively stable. This results in a lower "signal-to-noise" ratio during this period because data are subject to measurement error and, hence, bias the coefficients of reserve-based measures towards zero. Alternatively, Magliolo [1986, p. 98] suggests the downward drift in the coefficients could reflect bleaker expectations of future oil prices, assuming that firms' production rates are fairly constant. Oil prices did indeed suffer dramatic declines in the 1985–1987 period. The pattern of *CAR*s in the 1982–1984 SFAS No. 69 period suggests the market may have already been anticipating these troubled times. It appears that signals from OPEC and evidence of an impending oil glut may well have swamped any signals conveyed by either historical cost or reserve-based accounting numbers.

V. SUMMARY AND CONCLUSIONS

The perceived limitations of traditional historical cost-based accounting measures for oil and gas firms prompted the SEC and FASB to issue a series of pronouncements requiring supplemental disclosure of reserve recognition accounting (RRA) data in financial statements beginning in 1979. The SEC and FASB alleged that RRA measures would provide information relevant to evaluating the performance and future cash flow prospects of oil and gas firms that was not contained in traditional historical cost-based performance measures. In this study we have attempted to assess the empirical validity of these claims by: (1) examining whether changes in *HCNI* possess information in the sense of explaining cross-sectional differences in security returns; and (2) testing whether alternative reserve-based measures possess incremental explanatory power over historical cost earnings.

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[15] Only one-third of the production firms in our sample are surveyed by *Value Line*. Thus, it was impractical to replicate our entire analyses using *Value Line* analysts' forecast errors since this would have severely restricted our sample size.

The results of our analysis indicate that historical cost earnings as well as reserve-based measures constructed from RRA data for the period 1979-1981 are very useful, in terms of explaining cross-sectional security return differences. This finding is inconsistent with the claims made by the SEC in ASR Nos. 253 and 269, that traditional historical cost measures are of limited usefulness in assessing the performance and future cash flow prospects of oil and gas firms. Our findings tend to support the subsequent decisions of the FASB and SEC to continue requiring traditional historical cost-based accounting methods in the primary financial statements of oil and gas firms. These results are consistent with the findings of Harris and Ohlson [1987] who conducted an analysis of historical cost versus RRA asset measures in a cross-sectional valuation context. Thus, it would appear that historical cost income is a viable and relevant measure of the earnings of oil and gas firms.

Our findings that each of the reserve-based measures appears to possess useful information support the FASB's decision to require supplemental disclosure of changes in the present value of proved reserves from discoveries, extensions, price and quantity revisions, and other sources. The fact that *RRANI* adds little incremental explanatory power over *PVDIS* and *PVRPQ* measures is consistent with the FASB's decision to eliminate disclosure of an RRA earnings measure.

For the period 1982-1984 during which the reserve-based measures are constructed from SFAS No. 69 data, our results suggest that the information in historical cost earnings data as well as reserve-based measures is significantly lower than that observed during the earlier period. The decline in the information in reserve-based measures is consistent with prior research findings that in a period of relative oil price stability, reserve-based disclosures are relatively non-informative. The decline in the information in historical cost earnings data is more difficult to explain. Earnings model misspecification and signals from the world oil market that dominate accounting signals are possible explanations for the weaker relations in the SFAS No. 69 period.

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Federal Agency R&D Contract Awards and the FASB Rule for Privately-Funded R&D

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ABSTRACT: This study examines the contention that a change in the method of financial reporting for privately-funded research and development (Statement of Financial Accounting Standards No. 2 and Securities and Exchange Commission Accounting Series Release No. 178) may have affected the ability of small high-technology firms to secure federal agency contract awards for R&D. Even though cash flows were not changed, many of these firms had significantly negative changes in the accounting levels and ratios used by federal agency analysts in evaluating financial capability of contract bidders as part of a preaward survey. ANOVA and ANCOVA models on a set of 101 research-intensive firms, with under $100 million of sales in 1975 and analyzed over the time period 1970–1979, did not detect an effect on the dollar amounts of the awards. Also, a matched-pair comparative study did not demonstrate any significant differences between expensing (unaffected) and deferring (affected) firms. Based upon these results, it is concluded that there is no evidence that the R&D rule reduced the amount of R&D awards by federal agencies to small research-intensive companies.

IT has been frequently asserted that accounting reports based upon generally accepted accounting principles are user or decision-maker oriented, where the users are often identified as investors, creditors, management, and government regulatory agencies [FASB, 1978, para. 2]. Other users include federal agency officials who use financial statements as a condition for the awarding of a government contract. It may be asked, therefore: do accounting measurement changes produce a perceived decrease (increase) in a firm's financial status resulting in a reduction (increase) of the firm's ability to obtain federal contracts of a given size? Thus, the question concerns the indirect effects of accounting regulation.

This study focuses on a single mandated change that was known to have had significant financial statement effects for certain firms, some of which had R&D contracts with federal agencies

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[Horwitz and Kolodny, 1981, p. 254]. The purpose of this study is to determine whether accounting rule-making bodies, the Financial Accounting Standards Board (FASB) and Securities and Exchange Commission (SEC), may affect the contract evaluation decisions of federal agencies. The reactions of the financial analysts of these agencies to changes in measurement rules need to be considered. This is especially important for small growing firms, since federal agencies are likely to place a greater reliance on financial statements for such firms when considering their contract proposals. These small growing firms are recognized as important in new product and process development.

Among the findings of previous studies [Horwitz and Kolodny, 1980, 1981, and 1982] was the perception by managements of research-intensive firms required to switch to the expensing of R&D outlays in accordance with the FASB's SFAS No. 2 entitled, "Accounting for Research and Development Expenditures," that their firms might be disadvantaged with respect to federal agency contract awards. If correct, this could result not only in fewer and smaller total amounts of government contracts for those firms which have a vital role in innovation, but could also lead current or potential investors of those firms to provide lesser funds knowing that the size and amount of federal agency R&D contract awards may be reduced.

To date, no research has evaluated the effects of financial information changes on federal agency financial analysts and contract decisions.[1] Such research is particularly needed for small firms, since the financial history and contract experience is likely to be short and also because evidence suggests that federal agency analysts are more sensitive to the accounting levels and ratios of small firms than to those of large firms [Defense Logistics Agency, 1978, p. 10].

Two sources provide support for the possibility that federal agency financial analysts' decisions, required to be reached in no more than seven work days, may be influenced by mandated accounting changes though the direct, underlying cash flows are unaffected. Research on functional fixation has indicated that even investment officers and security analysts "... do not readily change the weights assigned to reported earnings in forming expectations about the prospects of the firm" [Abdel-khalik and Keller, 1979, p. 50]. When the measurement rule (LIFO vs. FIFO) changes, the respondents generally prefer firms with lower cash flows but higher profits. In the only known study of functional fixation and the application of accounting changes in the public sector, Barnes and Webb [1986] tested managers in a public organization where some were primarily engaged in commercial work and others in non-commercial government work. They concluded that there was much less fixation (38 percent) in the first group than in the second group (86 percent). These results, though suggestive, should be considered tentative, however, since they and similar studies exhibit methodological problems [Wilner and Birnberg, 1986].

Second, federal agency analysts may also react to accounting changes because they anticipate what they believe to be the reaction of the credit and equity markets. Reduced profits may affect dividend payouts and increased leverage may make future extensions of credit more costly, leading the analysts to place such firms in a riskier category for contract bids of a given size. Moreover, we should expect that in government agencies, given the reward structure, the analyst is more likely to respond to the agency's established guidelines even though an accounting change is recognized.

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[1] A search of the Lockheed Bibliography system revealed no articles on preaward surveys of financial responsibility by federal agencies in the past six years. The Accountant's Index had a few listings over the past decade, but these were not directly relevant to the use of financial statements. The Department of Defense provided the authors with a custom bibliography of articles appearing only within DOD during the last ten years; a reading of the microfiche copies revealed only a general description of the regulations for preaward surveys [Defense Logistic Studies Information Exchange, 1983].

The research reported here tests whether SFAS No. 2 (SEC Accounting Series Release No. 178), which required privately-funded R&D outlays to be expensed, affected the level of R&D federal agency contract awards to small high-technology firms which prior to the rule had capitalized R&D. Two government agencies were studied over the period 1970–1979, both separately and aggregated. The evidence, tests, and conclusions are presented below. Based upon the results of the tests, no significant effects were found. The paper is divided into the following sections: background (Section I); a discussion of the federal agency financial analysis (Section II); a description of the data, and sample section (Section III); and a description of the methods and results (Section IV) which support the discussion and conclusion (Section V).

I. BACKGROUND

To determine whether changes in financial reporting rules affect the evaluations of contract bidders by federal agency financial analysts, results of previous research on privately-funded R&D outlays is first presented. Horwitz and Kolodny [1980, 1981] found that the FASB mandated requirement to expense R&D investment outlays, when applied to small (under $100 million of sales) research-intensive firms which previously had deferred R&D, was associated with a decline in their privately-funded R&D outlays. In addition, Wasley [1984], using stock price data, not only found significant negative abnormal returns at the Exposure Draft date on a sample of small, deferral companies, but, using a generalized least squares estimation model for a cross-sectional analysis, also found a significant, positive relation between the magnitude of the negative abnormal returns (the dependent variable) and the change in firms' R&D outlays after the rule became effective. To explain the reduction, it has been suggested that unless those outlays were reduced, the ensuing lower earnings, lower equity, and the greater volatility of earnings would raise the incremental cost of capital or be perceived by management to do so.[2]

Another possible reason for reduced outlays by affected firms is their desire to not lessen their ability to get federal agency awards. In a questionnaire developed for a portion of their study of small research-intensive firms, Horwitz and Kolodny [1980] found that about 71 percent of the responses from financial officers of OTC firms deferring R&D outlays prior to the mandated change claimed that there would be either considerable or some difficulty in evaluating the performance of affected small firms by federal agencies. Moreover, in a study by the Department of Commerce concerning the rule's possible impact, it was stated that "smaller firms that contract with the Government will be placed in a less competitive position if write downs in net worth and irregularly reported income influence Federal purchasing procedures" [U.S. Dept. of Commerce, 1975, p. 8].

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[2] Elliott et al. [1984] find a similar association in a replication using a similar but larger sample, but argue that a causal relation may be partially inferred because of bias due to confounding variables, particularly "financial" weakness. The major problem with these studies is that they lack a theory or model of R&D expenditure. Such studies, including this one, however, are useful in that they may lead to theory development.

For some affected firms, the R&D rule had a significant impact on accounting numbers. A reconstruction of the time series of income for a sample of deferral companies, as if they had used the expensing method in the pre-SFAS No. 2 period, revealed that in the 1971–1974 period the mean income was reduced 92 percent and the median dropped 15 percent [Horwitz and Kolodny, 1980, 1982]. Some key ratios used in financial analysis also underwent sharp changes, including profit/sales (margin), profit/tangible assets and debt/equity. An important empirical question, therefore, is whether changes in accounting rules for R&D did, indeed, affect the level of federal R&D contract awards to small, research-intensive firms by federal agencies.

Even if reductions in privately-funded R&D were not directly made to reduce the negative impact on ratios, such reductions could have occurred indirectly if private and federally funded R&D were positively related and if the affected firms received smaller amounts of R&D awards than they might have otherwise. The extent to which private and government R&D are complements or substitutes was examined by Mansfield and Switzer [1982]. Based upon a sample of 25 energy firms they concluded that for each dollar of reduction in federal support there was a 25 cent reduction in the firms' privately-funded R&D. Levy and Terleckyi [1983], using an estimating equation in which government contract R&D outlay is an explanatory variable, concluded that there is an induced private R&D outlay of 27 cents per dollar of federal contract R&D. This study also revealed that there was an absence of any significant lag of these two variables, which the authors attributed to the possibility that companies believe that government support is more likely if their plans for private research are more integrated with R&D contract bids. Thus, unfavorable financial ratios could affect a firm's ability to secure federal R&D contracts, contributing to an observed decline in privately-funded R&D.[3]

II. Federal Agency Financial Analysis

All procurement contracts by federal agencies, whether invitations for bids or negotiated contracts, require preaward financial surveys which include an analysis of financial data provided by the potential contractor. The analysis is done informally by the contracting officer when the agency has had experience with the company and the experienced level of activity is not expected to increase significantly. Or, depending on the information available and the size of the award, the contract program officer and the Defense Contract Administration Services (DCAS) may perform a more formal technical and financial analysis. In either case, the contracting officer conducts a financial survey using the financial statements provided by the prospective contractor as well as information from Dun & Bradstreet, trade journals, SEC 10-Ks and similar sources. For public companies, the DOD financial analyst may use FINADAS, a computerized financial program which ac-cesses COMPUSTAT, DOD data, and prospective contractor-supplied data as input to assess the possible financial impact of a contract on the pro-forma statements. This program produces net profit/average equity, net profit/sales, net profit before taxes/assets, book equity/total debt, working capital/assets, and similar ratios and then develops a *Z*-score total for overall strength.

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[3] Lichtenberg [1984] criticized the aforementioned study for failing to include other firm characteristics, such as sales or science and engineering employment, as explanatory variables. Using such variables in cross sectional regressions, his regression results are consistent with the substitutability hypothesis rather than complimentarity.

The nationwide offices of DCAS make the majority of the Preaward Surveys (PAS) for the DOD and other federal agencies according to guidelines outlined in the armed services procurement regulations (earlier the Defense Acquisition Regulations but now the Federal Acquisition Regulations). The survey is a formalized procedure requested by the buying agency desiring to enter into a procurement contract. The DOD's acquisition policy states that the prospective contractor be "responsible" and that "doubt as to productive capacity or financial strength which cannot be resolved affirmatively shall require a determination of non-responsibility" [Defense Acquisition Regulation 1-902].

The DOD also requires that the evaluation of financial responsibility of the prospective contractor be completed within seven work days on Form DD1524-3. This form requires information about the prospective contractor's working capital, net worth, profit for the current and two previous years, current ratio, acid test ratio, and liabilities/net worth. These data are then used as a basis for a recommendation by the Financial Analyst. A Review Board reviews and approves or disapproves these PAS reports and recommendations, but before a negative PAS gets to the Review Board the Program Contracting Officer may suggest that the new contract be reduced in value to conform to the contractor's perceived financial capability, which then could lead to a positive recommendation [DLAM, 1983]. Thus, negatively affected ratios and levels need not lead to rejections, but may lead to reductions in dollar value of the contract proposals. (In the empirical data discussed later, zero values for firms in various contract years are, therefore, assumed to be years in which bids were not submitted rather than to be total rejections.)

An examination of the training guide [Financial Analysis Training Guide for Preaward and Postaward Financial Analyses, 1978] for financial analysts supports the importance of account balance levels and ratios, particularly for small firms.[4] Moreover, the analysis must be performed quickly because, as the Guide notes, "the time constraints for preaward review (seven working days for *both* technical and financial) do not always permit a detailed examination" [emphasis added]. Two kinds of companies are cited in the Guide as requiring special attention, companies with rapidly growing sales and small companies. Regarding the latter, the Guide states that "they frequently have limited capital and often are poorer risks than large companies since they are less able to absorb financial losses." Many research-intensive companies affected by the R&D rule were smaller and growing more rapidly than the typical small firm [Horwitz and Kolodny, 1982], suggesting a special wariness about such firms by federal agency analysts, particularly when key financial levels and ratios moved in unfavorable directions. The

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[4] The training guide was published in 1978 because previously "there [had] been a recent increase in the number of financial preaward surveys where less than an adequate financial analysis was made to support the recommendation made." [Financial Analysis Training Guide for Preaward and Postaward Financial Analyses, 1978, Appendix A.]

Guide also sets guidelines for certain ratios. For example, a ten percent ratio of net profit to tangible net worth is considered desirable.[5] As suggested earlier, the reward system of federal agencies likely encourages fixating on such guidelines when the changes in accounting measurement rules cause changes in financial ratios.

We focus on the changes in the levels and ratios of key financial data because federal agencies, not being wealth maximizers, are likely to concentrate on such data when making judgments about awards, insofar as financial capability is concerned. The financial analysts of these agencies are expected to be risk averse since they likely bear the risks of positively-recommended companies not being able to successfully perform on contract awards, but not the risks of negatively-recommended firms which might have successfully performed had their bid offers been accepted. Hence, the financial analyst and contract officer would be inclined to reduce the value of contract proposals when key levels and ratios become suddenly unfavorable, as occurred in 1975 when the affected firms switched from deferral to the mandated expense rule for R&D outlays. However, even if in part this were not so, the managements of small research-intensive firms may have perceived this to be so, and as a result may have been less inclined to submit as many contract proposals or, more likely, may have reduced the size of those submitted when key financial levels and ratios were negatively affected.[6]

The present study is based upon federal agency R&D contract awards of more than $10,000 from 1970–1979 with data provided by the DOD and NASA, together composing almost 70 percent of the total R&D outlays by federal agencies. Data on R&D contract awards were also sought from the Departments of Energy (DOE) and Health and Human Services (HHS), but the awards either were not in usable form prior to 1974 (DOE) or were too few in number over the time span to be included (HHS). Both the DOD and NASA data base contain all R&D awards over $10,000 during the time span, whether the awards were fixed price, negotiated, competitive, or sole source contracts. (Contracts for less than $10,000 are tabulated only at regional offices and are rarely awarded to firms with over $5 million of sales.) A ten-year series was chosen; the most current DOD computerized data base is for 1979, and 1970 is the earliest year for which financial data are available for most companies on Form 10-K. (As explained later, additional contract history from 1980–1982 was obtained in certain cases.)

None of the contract data bases identifies whether a preaward survey was performed. As was earlier discussed, we may assume that a survey was made whether by the contracting officer merely reviewing the financial statements of a known contractor or using the formal process of completing a Form 1524-3 of DOD or its equivalent for NASA. All of the contracts are awards to prime contractors. (The Federal Procurement Data Center did not collect data on subcontractor awards before 1979.)

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[5] In other descriptions of regulations concerning the preaward survey only "total net worth" is used [Armed Services Procurement Regulation, Appendix E-214m, 1976]. The Form DD1524-Part III requires information on the ratio of total liabilities to net worth, not tangible net worth.

[6] The anonymous referee contends that the firm could spend resources on educating the financial analyst about the firm's "true" state. While this may be so, it is unlikely to occur for several reasons: (1) the cost to the analyst of recommending an award with unfavorable accounting ratios is high given the reward structure; (2) the analyst is concerned with an expectation of how the "uneducated" observer is likely to react; (3) fixating on ratios is likely safer than examining cash flows when the analyst's judgment is called into question. Thus, the certain costs most often exceed the uncertain benefits to the analyst. For a similar observation about government investment generally see Lee [1987, p. 78].

An empirical study examining the impact of changes in levels and ratios of financial accounting numbers would be inadequate if the definition of R&D had changed over the tested time period.

An inquiry at the DOD, the largest (more than 60 percent) source of R&D contracts, and further inquiry at the Office of Management and Budget, revealed that the definition of R&D did not change during the time period over which the tests, described later, were run. The standardized definition of R&D covers the following categories: research, exploratory development, advanced development, engineering development, operational system development, and commercialization.

III. DATA AND SAMPLE SELECTION

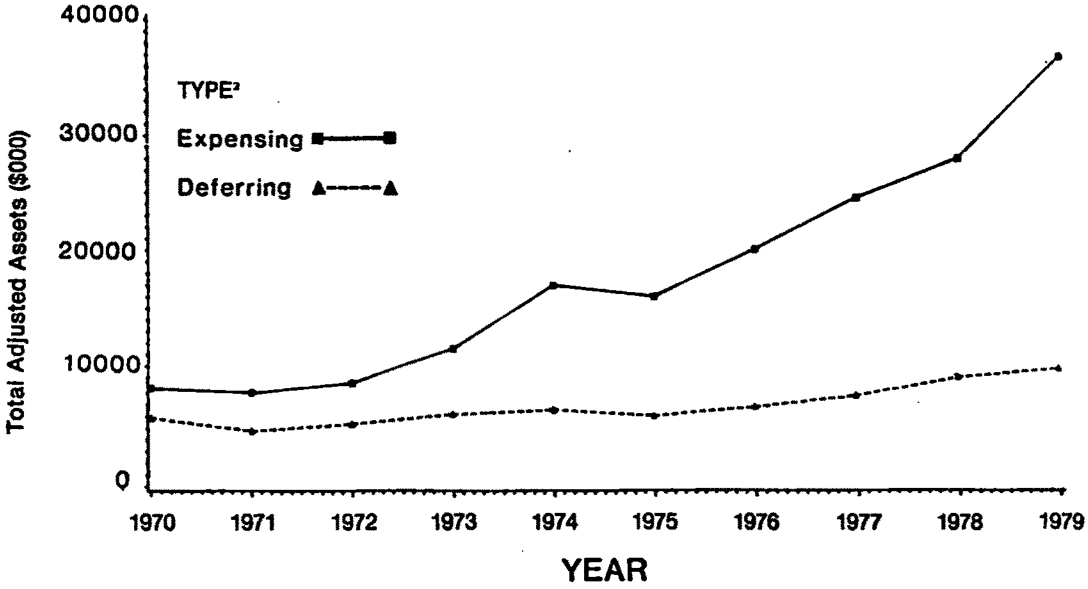
From a list of firms with significant R&D outlays used in previous studies which examined privately-funded R&D [Horwitz and Kolodny, 1981 and Elliott et al., 1984] and which used either the expense or deferral method for reporting their R&D outlays, a population of 312 public firms was established. Firms were then eliminated if their sales in 1975 amounted to more than $100 million in order to confine the sample to small companies. The financial data were obtained from three sources: COMPUSTAT, firm SEC 10-K's, and Moody's Industrial Index. Data were collected on total sales, net profit before taxes, total equity, long term debt, current liabilities, and current assets. Firms with no DOD or NASA R&D contracts over the significant period of time were eliminated. All the remaining 101 firms have a ratio of privately-funded R&D/sales in 1975 greater than one percent, 61 expensed their R&D expenditures before 1975 and 40 deferred at least some of their R&D expenditures for the same period. Of the deferring firms, 22 wrote off their accumulated R&D expenditures in 1974, and 18 firms switched in 1975. Total assets of the deferring firms were adjusted to account for the write-off of R&D.

The Appendix lists the sample firms along with the following characteristics: deferral or expense of R&D, year of the mandated switch to the expense method for deferral firms, three-digit SIC number, industry classification category, average assets (adjusted for deferral firms) before and after switch, average contracts before and after switch. Figures 1 and 2 plot total assets and federal R&D contract values for the period for both deferring and expensing groups. Each time series is adjusted to 1972 base-year prices.

Each firm was placed in a three-digit SIC group. However, this resulted in 26 SIC categories, eight of which contained only one firm each. A variable named industry group was constructed based on the definition of the SIC codes in order to preserve the intent of the SIC codes while producing larger cells for more reliable results in analyses of variance and in matching procedures.

The total value of each contract from 1970 through 1979 was collected and assigned to the year in which the contract was awarded. Two-thirds of the contracts were completed within one year. For the one-third that were not, further details were requested of any contracts still active in 1979 to prevent biasing later award sizes downward; therefore, 1980–1982 histories (again for about one-third of the contracts still active in 1979) were collected for the sample and applied to the relevant contracts in 1979.

FIGURE 1
MEDIAN ADJUSTED ASSETS—ALL FIRMS[1]
1970–1979
($n=101$)



[1] 1972 prices
[2] $n=61$ Expensing
=40 Deferring

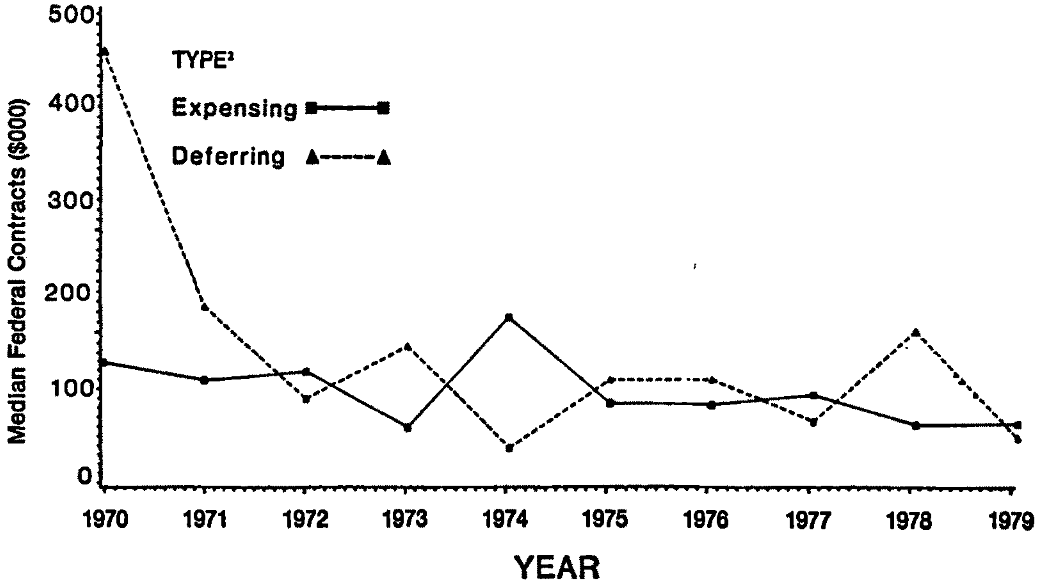
IV. METHOD AND RESULTS

The tests for differences between the group of firms which deferred their R&D costs prior to 1975 and the group of firms which expensed their R&D costs are described in this section. The dollar value of the R&D contracts awarded by DOD and NASA after the deferring firms switched to expensing their privately-funded R&D, compared to the value obtained before the switch, is of particular interest.

Since the change of the value of the R&D contracts awarded over time is of interest, a time series study would be appropriate. However, the short duration of the available series prevents consideration of Box-Jenkins models, and the relatively small numbers of observations makes a profile analysis impractical. In addition, since the award patterns for many firms contain zero values, the normality of a time profile is called into question, invalidating an assumption of the profile analysis model.

All of the tests are performed on the original data and on the ranks of the data to protect against invalidation of the tests by the possible non-normality of the time series. Performing linear statistical tests on the ranks is asymptotically equivalent to the common nonparametric tests (for instance, the ANOVA is replaced by the Kruskal-Wallis test), and is shown by Conover and Iman [1981, pp. 124–129] to be a good approximation to the nonparametric test at the sample sizes considered here. A radical difference in the outcomes of the para-

FIGURE 2
MEDIAN R&D CONTRACTS—ALL FIRMS[1]
1970-1979
(n=101)



[1] 1972 prices
[2] n=61 Expensing
=40 Deferring

metric and rank tests would be a warning that the assumptions of the parametric test may be in doubt.

The value of R&D contracts awarded by NASA and DOD is the dependent variable in this series of tests. The ten-year time series of the value of these contracts is quite variable (see Figure 2), therefore averages across years are used. Of the 40 firms in the deferring group, 22 switched from deferring to expensing their R&D costs in 1974, while the balance switched in 1975. Two averages of each variable are constructed for every firm to eliminate complications induced by the different dates of change. For the deferring firms, the first average is over the 1970-1974 or 1970-1975 period, depending on the year in which the firm switched to the expensing method. The second average is constructed from the complement of the first (i.e., 1975-1979 or 1976-1979). Averages for all the expensing firms are based on the periods 1970-1974 and 1975-1979, respectively. The differences in the averages, representing the change across the time period, are also constructed. To summarize, each firm is associated with six financial variable statistics: DOD and NASA contract value and adjusted assets, measured in pre-switch and post-switch periods, and differenced. Each of pre- and post-switch variables are presented in units of thousands of dollars per year, while the unit of the difference variables is the change in yearly value (in thousands of dollars).

In order to demonstrate that aggregating deferring firms which switched accounting methods in different years does not induce a confounding variable (year

TABLE 1
TESTS TO COMPARE DEFERRING FIRMS WHICH SWITCHED ACCOUNTING METHODS IN 1974 TO DEFERRING FIRMS WHICH SWITCHED IN 1975 WITH RESPECT TO ADJUSTED ASSETS AND DOD CONTRACT LEVELS
($n=40$)

Period[1]	Dependent Variable[2]	Dollars		Ranks	
		t-statistic	Probability[3]	t-statistic	Probability
Before	Assets	−0.03	0.97	−0.22	0.82
Before	Contracts	−0.68	0.50	−1.20	0.24
After	Assets	−0.05	0.96	0.33	0.75
After	Contracts	0.11	0.91	1.24	0.22
Difference	Assets	−0.05	0.96	0.72	0.47
Difference	Contracts	0.65	0.52	1.34	0.19

[1] Before or After Accounting Method Switch, or Arithmetic Difference between the periods.
[2] Dependent Variable is average value over the specified period.
[3] Two-tailed.

of switch), a series of tests hypothesizing no difference in the financial measurement variables between the firms which changed in 1974 and the firms which changed in 1975 are presented in Table 1. Since none of these tests reject the null hypothesis of no difference, it is concluded that the year in which a firm changed accounting method is not associated with the value of its DOD and NASA contracts or adjusted assets, either before or after the rule change was adopted.

Table 2 presents simple hypothesis tests concerning the difference in mean DOD and NASA contract values and adjusted assets. The average value of DOD and NASA contracts per year in the pre-switch period is $420,625 for the deferring group and $315,213 for the expensing group, resulting in a difference of $105,412. However, this difference is not significant ($p=0.60$) due to the large spread of values, as confirmed by the confidence interval for the difference ($105K±392K). In the post-switch period, the gap between the deferring and expensing firms increases to $168,830 (a difference which is still not statistically significant, $p=0.71$). Thus, when considering unadjusted means, there is no significant difference in DOD and NASA contract levels between the deferring and expensing firms, although the deferring firms have a numerically larger average contract value over both periods.

Adjusted assets of both deferring and expensing firms increased significantly ($p<0.01$) over time, as demonstrated in Table 3, even though the value of DOD and NASA contracts is not ($p=0.29$ and $p=0.28$ for the expensing and deferring firms, respectively). While there is a difference between the parametric and rank tests as to the significance of the difference in adjusted assets between the two groups of firms in the pre-switch period ($p=0.35$ for the t-test vs. $p<0.01$ for the rank test), the firms in the expensing group are significantly larger (on the average, 80 percent larger, a difference significant at level $p<0.01$) in the post-switch period. The remainder of the analysis seeks to identify differences in DOD and NASA contract values due to

TABLE 2
ANOVA SUMMARIES FOR DIFFERENCES BETWEEN DEFERRING AND EXPENSING FIRMS WITH RESPECT TO ADJUSTED ASSETS AND DOD CONTRACT LEVELS
($n = 101$)

				Dollars			*Ranks*	
Period[1]	*Dependent Variable*[2]	*Predictor Variable*[3]	*Covariate*[4]	*Parameter Estimate*[5]	*t-statistic*	*Probability*	*t-statistic*	*Probability*
Before	Assets	Method		−3007.74 ± 6206.81	−0.95	0.35	−2.89	<.01
Before	Contracts	Method		105.41 ± 392.0	0.53	0.60	0.71	0.48
Before	Contracts	Method	Assets	120.66 ± 394.50	0.60	0.55	0.93	0.35
After	Assets	Method		−15581.83 ± 13306.26	−2.30	0.02	−4.36	<0.01
After	Contracts	Method		168.83 ± 889.92	0.37	0.71	−0.46	0.65
After	Contracts	Method	Assets	210.21 ± 894.37	0.46	0.65	0.00	0.99
Difference	Assets	Method		−12574.08 ± 10248.41	−2.40	0.02	−4.14	<0.01
Difference	Contracts	Method		63.42 ± 578.78	0.22	0.83	−0.18	0.86
Difference	Contracts	Method	Assets	89.55 ± 581.83	0.30	0.76	−0.04	0.96

[1] For Deferring firms, before or after accounting method switch; for Expensing firms 1970–1974 vs. 1975–1979.

[2] Dependent Variable is averaged over the specified period.

[3] Expensing vs. deferring.

[4] Total Assets, adjusted for deferring firms' write-off at the rule switch, and averaged over the appropriate period. The rank test uses the rank value of the same variable.

[5] 95 percent Confidence interval for regression parameter of predictor variable.

TABLE 3

PAIRED-COMPARISON TESTS FOR DIFFERENCES BETWEEN PRE-SWITCH AND POST-SWITCH ADJUSTED ASSETS AND DOD CONTRACT LEVELS[1]

			Dollars			*Signed Rank*	
Group	*Dependent Variable*	n	*Average Change*[2]	t-*statistic*	*Probability*	*Wilcoxon statistic*	*Probability*
Expensing	Assets	61	19518.50 ± 7989.35	4.89	<0.01	899.5	<0.01
Expensing	Contracts	61	193.93 ± 365.70	1.06	0.29	−101.0	0.46
Deferring	Assets	40	6944.38 ± 4231.98	3.28	<0.01	287.0	<0.01
Deferring	Contracts	40	257.35 ± 470.08	1.10	0.28	−50.5	0.28

[1] Paired-comparison *t*-test of the pre-switch and post-switch average levels (over time) of the indicated variables for the separate groups of firms. Each firm's before-switch average is the control for its post-switch average.

[2] 95 percent Confidence interval of average change from pre-switch to post-switch period.

accounting method employed which are masked by differences in firm size and/or primary industry.

When adjusted assets is introduced as a covariate in the regression equations, the absolute size of the difference in contract value due to the accounting method increases, since the deferring firms achieve a larger average dollar value of NASA and DOD awards in spite of their smaller size. For instance, as seen in Table 2, the regression coefficient representing accounting method changes from $105,412 to $120,660 per year in the pre-switch period when adjusted for size (as measured by adjusted assets). However, the difference in DOD and NASA contract values is still insignificant ($p=0.55$ in the case mentioned), and the models, even with adjusted assets included as a covariate, still explain only a small proportion of the variance in DOD and NASA contract values in the pre- and post-switch periods.

The difference between the deferring and expensing firms in the *change* of the mean level of the covariate, adjusted assets, over the ten-year period may introduce bias into the prior analyses, even if adjusted assets is included as a covariate. Two methods were used to control the possible bias: pairwise matching of the deferring and expensing firms, and regression adjustment of the dependent variable. Within the sample, expensing firms are matched to deferring firms within the same industry group of approximately the same size, as measured by adjusted assets in the pre-switch period. The matching process, Mahalanobis nearest neighbor available pair matching, is described in Anderson et al. [1980, pp. 101–103]. All of the results in Tables 4, 5, and 6 refer to this matched subsample of firms: the tests reported in Tables 4 and 5 use the matched sample, but ignore the matching structure; the tests in Table 6 make use of the actual deferring/expensing structure, by adding the match numbers as a 33-level categorical variable to the ANOVA/ANCOVA. The categorical variable constitutes the regression adjustment; the use of the matching process together with the regression adjustment is discussed in Rubin [1973].

Tables 2 and 4 are similar to Tables 3 and 5, both in structure and content, indicating that the matching process does not qualitatively alter the results. In fact, although the matching was performed on pre-switch adjusted assets, the difference between the means of pre-switch adjusted assets of the deferring and expensing firms is actually larger in the matched sample, due to the deletion of several relatively large deferring firms for which suitable industry matches could not be found. However, the level of adjusted assets of the expensing firm decreases in the matched set (as would be expected). The adjusted assets of the subset of expensing firms is still significantly larger ($3.3M larger, on the average, in the pre-switch period and $19.1M larger in the post-switch period) and growing larger faster than the subset of deferring firms. But the subset of the deferring group still nominally outperforms the expensing subset with respect to DOD and NASA contracts, even when size is taken into account.

Table 5 indicates that the matching process eliminates the expensing firms which are strongest with respect to growth in DOD contract value (the mean change decreasing from $193,930 to $54,030) and the deferring firms which are weaker in growth in DOD contracts (so that the mean change *increases* from $257,350 to $296,790), which should exacerbate any difference in contract levels with respect to accounting methods in the post-switch period. However,

TABLE 4

ANOVA SUMMARIES FOR DIFFERENCES BETWEEN MATCHED DEFERRING AND EXPENSING FIRMS WITH RESPECT TO ADJUSTED ASSETS AND DOD CONTRACT LEVELS[1]

$(n=66)$

				Dollars			*Ranks*	
Period[2]	*Dependent Variable*[2]	*Predictor Variable*[2]	*Covariate*[2]	*Parameter Estimate*[2]	*t-statistic*[2]	*Probability*	*t-statistic*[2]	*Probability*
Before	Assets	Method		−3325.73 ± 7040.76	−0.95	0.35	−2.05	0.04
Before	Contracts	Method		89.12 ± 469.62	0.38	0.71	−0.01	0.99
Before	Contracts	Method	Assets	146.72 ± 460.26	0.64	0.53	0.30	0.77
After	Assets	Method		−19126.42 ± 18728.42	−2.04	0.05	−3.13	<0.01
After	Contracts	Method		331.88 ± 940.33	0.71	0.48	−1.20	0.24
After	Contracts	Method	Assets	474.03 ± 904.16	1.05	0.30	−0.66	0.51
Difference	Assets	Method		−15800.70 ± 14923.48	−2.12	0.04	−3.05	<0.01
Difference	Contracts	Method		242.76 ± 615.20	0.78	0.44	0.45	0.65
Difference	Contracts	Method	Assets	327.31 ± 607.96	1.08	0.29	0.67	0.50

[1] Only the deferring and expensing firms which were matched are in this series of tests, although the actual matching structure is not considered (i.e., the firm-match is not entered in the ANOVA/ANCOVA).

[2] Same as Table 2.

TABLE 5

PAIRED-COMPARISON TESTS FOR DIFFERENCES BETWEEN PRE-SWITCH AND POST-SWITCH ADJUSTED ASSETS AND DOD CONTRACT LEVELS[1]

			Dollars			Signed Rank	
Group	*Dependent Variable*[2]	n	*Average Change*[2]	*t-statistic*[2]	*Probability*	*Wilcoxon statistic*[2]	*Probability*
Expensing	Assets	33	22890.20 ± 14066.28	3.25	<0.01	271.5	<0.01
Expensing	Contracts	33	54.03 ± 268.28	0.41	0.69	−59.5	0.27
Deferring	Assets	33	7089.48 ± 4984.99	2.84	<0.01	181.5	<0.01
Deferring	Contracts	33	296.79 ± 564.71	1.05	0.30	−30.5	0.56

[1] Same test as in Table 3, but on matched firms.

[2] Same as Table 3.

TABLE 6

ANOVA SUMMARIES FOR DIFFERENCES BETWEEN MATCHED DEFERRING AND EXPENSING FIRMS WITH RESPECT TO ADJUSTED ASSETS AND DOD CONTRACT LEVELS[1]

($n=66$)

				Dollars			Ranks of Data	
Period[2]	*Dependent Variable*[2]	*Predictor Variables*[1]	*Covariate*[2]	*Regression Parameter*[2]	t-*statistic*[3]	*Probability*	t-*statistic*[3]	*Probability*
Before	Assets	Method Match		−3325.73±3493.19	−1.94	0.06	−3.33	<0.01
Before	Contracts	Method Match		89.12±509.33	0.36	0.72	−0.01	0.99
Before	Contracts	Method Match	Assets	185.89±536.13	1.13	0.27	0.35	0.73
After	Assets	Method Match		−19126.42±14416.31	−2.71	0.01	−4.29	<0.01
After	Contracts	Method Match		331.88±992.58	0.68	0.50	−1.26	0.22
After	Contracts	Method Match	Assets	613.35±1017.86	1.23	0.23	−0.73	0.47
Difference	Assets	Method Match		−15800.70±14635.82	−2.20	0.04	−3.20	<0.01
Difference	Contracts	Method Match		242.76±641.25	0.77	0.44	0.44	0.66
Difference	Contracts	Method Match	Assets	427.45±656.57	1.33	0.19	0.98	0.34

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[1] Same reduced set of firms as in Tables 4 and 5, but the matching structure is considered here (i.e., the match number is entered as a predictor level in the ANOVA/ANCOVA).

[2] Same as Table 2.

[3] Test of H_0: method has no effect on dependent variable, after adjustment for match and covariate (if present).

[4] 95 percent Confidence interval for regression parameter of method.

the differences between deferring and expensing firms in DOD and NASA contract value, even after adjusted assets are considered, are not significant in the pre-switch period (Table 4, $p=0.53$), the post-switch period ($p=0.30$), or over time ($p=0.29$).

In Table 6, the matched-pair structure is introduced, so that the expensing firm of each expensing/deferring pair acts as a "control" to the deferring firm. Because of the orthogonality of the matched pair variable to the accounting method variable, the introduction of the matched pair structure has no effect on the estimate of the mean effect of the accounting method (although the standard error of the estimate changes) unless the covariate, adjusted assets, is also in the regression equation. Addition of the covariate increases the effect of the accounting method, but the effect of method is still not significant in the pre-switch or post-switch period, or over time ($p=0.27$, $p=0.23$, and $p=0.19$, respectively). So, even after considering the covariate of size, and a matching procedure expressing industry group and size, we detect no significant difference between the expensing and deferring groups with respect to yearly DOD and NASA contract levels. Furthermore, the difference is still nominally in favor of the deferring firms.

To summarize, we have seen that the expensing firms start out slightly larger (as measured by adjusted assets) than the deferring firms, and then grow (significantly) more rapidly over time. The deferring firms maintain a positive but statistically insignificant edge in the ability to attract DOD and NASA R&D contracts over all tests, when compared to all expensing firms and a subset matched by adjusted assets and industry group, whether or not size is introduced as a covariate. Thus, we have no statistical evidence to conclude that accounting method influences the ability of the firms to procure DOD and NASA R&D contracts.

To achieve a better visual image of the impact of rule change on the acquisition of federal R&D contracts, firms in the top quartile of the 1973 debt/equity ratio were examined. Because of the requirement to write-off to equity previously capitalized R&D and because company-funded R&D outlays were required to be expensed, the above set of firms would likely have had the debt/equity ratio move closer to or beyond a point considered unacceptable to federal agency financial analysts. Hence, it would be expected that the deferral subset of this above group would have shown the most significant decline in federal R&D contract awards both with respect to the pre-FAS No. 2 period and with respect to the "control" group of expense firms. Figure 3 shows the median debt/equity ratio from 1970–1979 for those firms in the top quartile of debt/equity in 1973. From 1975–1977 there was a sharp increase for deferral firms, but the decline of median contracts in that period, as seen in Figure 4, was minimal, not different from the years prior to 1974 and clearly not as steep a decline as the expense group. Here, also, there was no statistically significant decline in federal R&D awards following the rule change.[7]

V. Conclusion

The purpose of this study was to determine whether the accounting rule change for R&D in 1975 significantly affected contract awards by government agencies to companies required to change from the deferral to the expense

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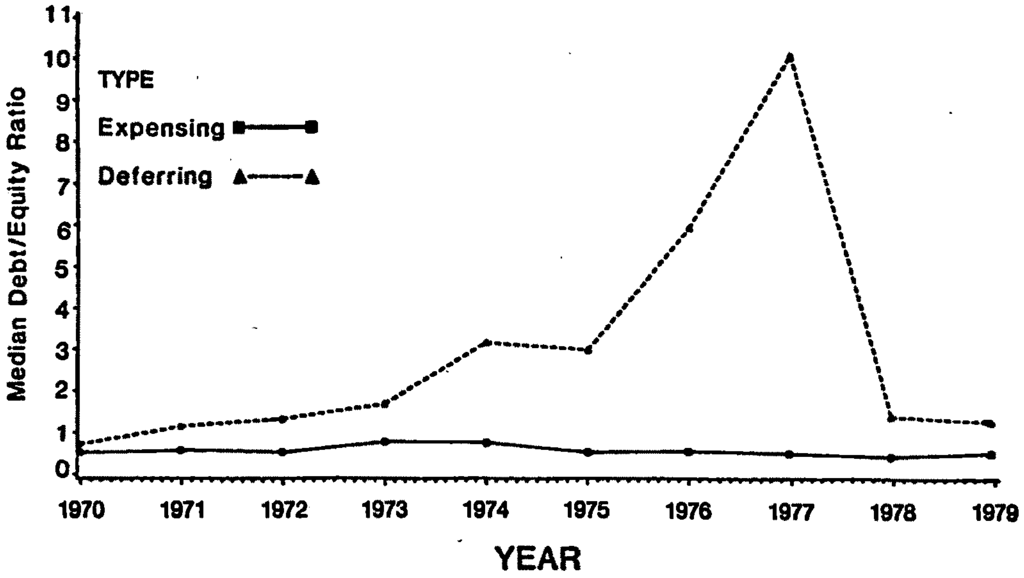
[7] All of the above tests were also performed on the contracts/sales ratio as the dependent variable and all the results were statistically insignificant.

FIGURE 3
TOP QUARTILE OF THE 1973 DEBT/EQUITY RATIO



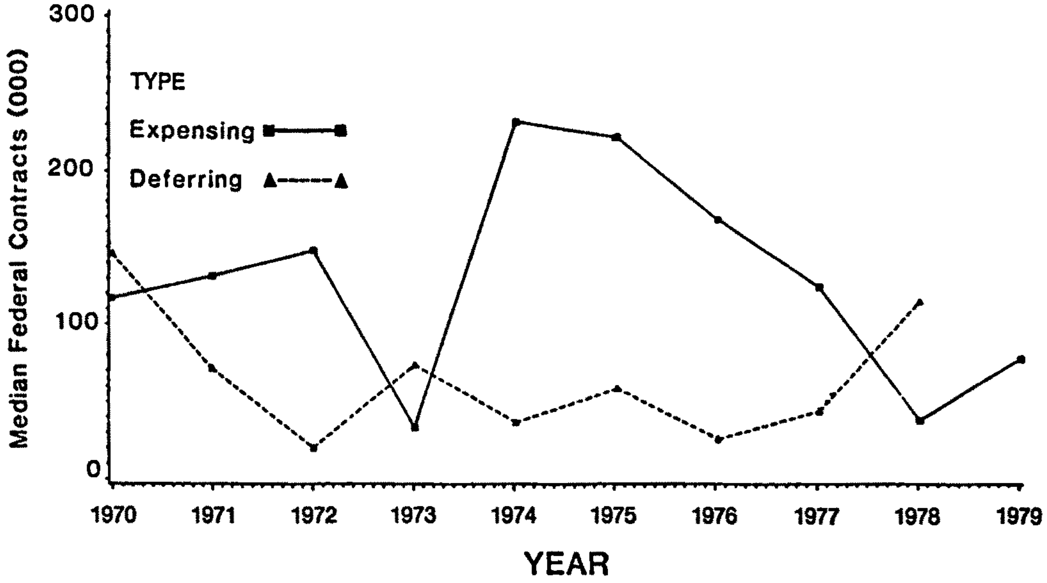
method. The analysis was confined to small firms (under $100 million sales in 1975) which were research-intensive (exceeding company-sponsored R&D outlays to sales of one percent) and which had a useable financial history over the test period 1970–1979. A sample of 40 deferral and 61 expensing firms was obtained. Since the study was confined to R&D firms, data were collected on DOD and NASA awards of R&D contracts to a test sample of firms, all of which received awards of at least $10,000 during the test period.

An analysis of the expensing and deferral firms revealed that both have different rates of growth (as measured by adjusted assets) over the ten-year period, and that the expensing firms were, on the average, somewhat larger than the deferral firms in the pre-switch period. Also the size difference increased in the post-switch period. Parametric and nonparametric ANOVA and ANCOVA which aggregated firms into two samples, pre- and post-FAS No. 2, were not statistically significant. Introducing adjusted assets (without capitalized R&D) as a covariate also did not lead to statistically significant results.

Tests were then performed on a subset of the original firms, where deferral firms were matched to expensing firms of approximately the same size and industry. Although the expensing firms in this subset experienced a higher growth rate in terms of adjusted assets, there remained no significant difference in the R&D contract award level between the two groups. We conclude, therefore, that there is no statistical evidence that changes in the R&D reporting rule affected the level of contract awards by federal agencies in spite of anecdotal and survey evidence suggesting that this may have occurred.

FIGURE 4

VALUE OF CONTRACTS OF TOP QUARTILE OF THE 1973 DEBT/EQUITY RATIO[1]



[1] 1972 prices

The conclusion cannot, of course, be extrapolated to changes in other measurement rules. One implication of the assumptions, but not the conclusions, of this study is that small, high-technology companies with significant government contracts are more likely to select accounting methods, where choice exists, that are "liberal" to enhance the likelihood of government contracts awards.

APPENDIX

Firm	*Type*	*Switch Year*	*SIC*	*Industry*	*BEFASSET*[1]	*AFTASSET*	*BEFCON*	*AFTCON*
Adage, Inc.	E		357	C	3565	3637	202	27
Aerotron, Inc.	E		366	D	4366	7325	10	0
Altair Corp.	E		204	G	4286	11446	3	0
American Microsystems	E		367	D	38173	56504	131	10
Analog Devices, Inc.	E		367	D	10913	43623	13	0
Anderson Jacobson, Inc.	E		357	C	14071	28180	15	27
Applied Data Research, Inc.	D	1974	737	F	6341	10971	1151	639
Baird Atomic, Inc.	E		383	E	12106	19688	520	222
Biospherics, Inc.	D	1975	739	F	960	1533	203	19
Buckbee Mears Co.	E		367	D	32199	46166	0	3
Butler National Corp.	D	1975	366	D	2478	2099	9	0
California Microwave	E		366	D	3657	11453	0	218
Cambridge Memories	E		357	C	18647	19871	25	0
Carboline Co.	E		282	A	9711	21658	0	4
Compuscan	E		357	C	4511	14843	38	0
Computer Automation	E		357	C	9133	30487	0	35
Computer Communications	E		357	C	4549	10138	13	0
Computer Products	E		382	E	1389	5559	40	17
Computer Vision Corp.	E		357	C	12977	41124	39	59
Comshare, Inc.	E		737	F	9350	19046	30	330
Comtec Laboratory	D	1975	366	D	5072	12295	81	0
Comten, Inc.	E		357	C	7969	26311	0	33
Cyclotron Corp.	D	1975	366	D	1625	4241	6	0
D B A Systems, Inc.	D	1974	737	F	1925	3167	1653	2854
Data Products Corp.	D	1975	357	C	68767	103748	27	15
Datascope Corp.	D	1975	369	D	2150	8957	20	0
Dewey Electronics Corp.	D	1975	366	D	4390	2345	68	942
E S L, Inc.	E		357	C	5484	16690	6034	16198
Eberline Instrument Corp.	E		382	E	4885	6912	5	0
EDO Corp.	E		366	D	32324	40905	2040	4737
Educational Development Corp.	D	1975	273	A	5551	8763	0	28
Electro Nucleonics	D	1975	381		10603	12645	4	0
Energy Conversion Devices	D	1975	739	F	4060	2131	121	70
Fabri Tek, Inc.	D	1975	367	D	20361	16847	46	12
Fabrinon Corp.	E		366	D	17884	48580	0	3
Farr Co.	E		356	C	17965	24001	3	0
Finnigan Corp.	E		383	E	5391	15911	0	6
General Aircraft Corp.	D	1974	372	D	2477	1319	337	0
General Automation	E		357	C	25244	72962	0	30
Gilford Instrument Labs, Inc.	E		381	E	8708	191810	0	0
Graham Magnetics	D	1975	367	D	8729	14361	10	0
Hazeltine Corp.	D	1974	357	C	47958	58556	2791	10537
Horizons Research, Inc.	D	1974	386	F	3973	3398	36	76
Industrial Nucleonics Corp.	D	1974	737	F	73112	97298	141	19
Information International, Inc.	E		357	C	10029	19037	251	0
Infrared Industries	D	1974	382	E	6492	6603	71	26
Intercontinental Dynamics Corp.	E		381	E	4753	7771	5	15
International Video Corp.	E		366	D	10739	6871	5	3
Irvin Industries, Inc.	D	1974	239	G	25609	31606	0	34
K M S Industries, Inc.	D	1975	366	D	17716	2959	2182	0
Kalvar Corp.	D	1975	386	E	8602	4929	5	0
Keuffel & Esser Co.	E		381	E	46962	66159	304	15
Kewaunee Scientific Equipment Corp.	E		381	E	18929	26304	0	4
Keydata Corp.	D	1974	737	F	5530	10627	340	244
Kollmorgen Corp.	D	1975	362	D	38287	59929	1207	74
Logetronics, Inc.	E		386	E	10637	12886	10	0

APPENDIX—*Continued*

Firm	*Type*	*Switch Year*	*SIC*	*Industry*	*BEFASSET*[1]	*AFTASSET*	*BEFCON*	*AFTCON*
Loral Corp.	D	1975	366	D	24543	87792	5747	10153
M T S Systems	E		381	F	10052	29998	526	351
Mathematica	D	1975	739	F	3458	8057	56	102
Micro Data Corp.	E		357	C	6421	31190	15	4
Microwave Semiconductor	D	1974	366	D	5160	8198	0	9
Millipore Corp.	E		381	E	22483	77822	34	0
Modular Computer Systems	E		357	C	18854	47782	120	1334
Moog, Inc.	D	1974	372	D	22654	57214	277	1107
Narco Scientific, Inc.	E		384	E	36187	44292	0	31
Nicolet Instrument Corp.	E		382	E	4425	20284	0	48
Nuclear Systems, Inc.	D	1975	381	E	3590	4441	65	0
Optical Coating Laboratories	E		383	E	11029	24197	97	183
Optical Radiation	D	1974	364	D	3449	6834	108	0
Oregon Freeze Dry Foods	E		203	G	3864	5008	0	6
Pako Corp.	E		386	E	26960	45754	0	4
Prime Computer Corp.	E		357	C	5786	53204	723	42
Ragen Corp.	E		349	B	8630	11181	24	0
Raymond Corp.	D	1974	353	C	24442	45910	0	14
Rem Metals Corp.	D	1974	354	C	2824	6947	52	12
Resdel Engineering Corp.	E		366	D	9637	18266	1421	117
Research, Inc.	E		382	E	3306	7065	317	8
Robbins & Myers, Inc.	E		356	C	40641	63173	0	3
Scope, Inc.	E		357	C	12891	33913	877	178
Sheldahl, Inc.	E		307	G	11312	24407	27	43
Siliconix, Inc.	E		367	D	14384	29689	3	45
Solid State Scientific Corp.	E		367	D	8069	19641	31	0
Spectra Physics	E		381	E	10117	38641	30	18
Spectral Dynamics Corp.	E		381	E	5967	10855	132	2963
Standun, Inc.	D	1974	354	C	12879	19583	0	6
Storage Technology Corp.	E		357	C	56192	212200	0	91
Superior Electric Co.	E		362	D	25858	29256	14	8
T Bar, Inc.	D	1974	367	D	1627	6664	0	30
Technical Communications, Inc.	D	1974	357	C	325	935	0	0
Technical Material Corp.	D	1974	366	D	8912	5635	11	0
Technology, Inc.	E		371	D	10020	10186	3135	2452
Terminal Data Corp.	D	1974	386	E	1546	5778	0	13
Thermo Electron	E		356	C	27184	50049	18	223
Threshold Technology, Inc.	D	1974	357	C	400	1240	0	82
Tymshare, Inc.	E		737	F	12947	73743	293	207
U T L Corp.	E		366	D	3656	5373	0	2
Valtek, Inc.	D	1974	349	B	1283	11983	0	2
Varo, Inc.	E		367	D	20305	45380	1603	681
Vernitron Corp.	E		362	D	33836	49888	40	20
Volt Information Sciences	D	1974	739	F	19109	28006	0	0
Wurlitzer Co.	E		393	E	77131	63981	12	0

[1] BEFASSET = Total assets before the change
AFTASSET = Total assets after the change
BEFCON = Value of contracts before the change
AFTCON = Value of contracts after the change
All entires are in thousands of dollars.

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Not-For-Profit Accounting and Auditing in the Early Eighteenth Century: Some Archival Evidence

G. A. Swanson and John C. Gardner

ABSTRACT: Developments of accounting concepts and procedures in governmental, religious, and eleemosynary organizations have received scant attention in the literature. This study examines an extensive store of primary documents that chronicle the early development of the United Society for the Propagation of the Gospel in eighteenth century England. It concludes that the immediate impetus for auditing in the Society came from business practices rather than from government and that rudimentary managerial accounting procedures emerged in the Society as a result of internal needs for planning and control in much the same way they were emerging in businesses of the period.

THE development of business accounting practices and methods in eighteenth century England has been examined in some depth. Parallel developments in governmental, religious, and eleemosynary organizations have commanded little attention. The purpose of this study is to document evidence of accounting concepts, practices, and procedures in the primary records of the archives of perhaps the most prominent religious-eleemosynary English organization of the period, "The Society for Propagating the Gospell in Forreign Parts" (Society). In doing so, we attempt to set the evidence in the context of related historical developments and identify some implications that may aid the understanding of contemporary accounting.

A number of accounting historians from Sombart [Most, 1972, 1979] to Winjum [1972] have examined the role of accounting/auditing in western society since the late Middle Ages and have made various claims about the accounting practices of businesses. These writers have generally stressed that double-entry bookkeeping played a significant role in the development of capitalism in its formative stages. Sombart theorized that accounting was necessary so that ratio-

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nal business persons could calculate profit or loss and because it allowed individual merchants to keep adequate records in order to properly arrange their affairs.

Yamey [1947, 1949, and 1964], Skandera [1972], Most [1972], Winjum [1972], and Strachan [1984], among others, have discussed Sombart's ideas about the contribution of accounting to the development of capitalism, presenting evidence of support and contradiction. These discussions center on the connection of accounting to the concept of capital. However, they involve extensive analysis of accounting concepts and methods that concern eighteenth century England.

In order to see how deeply accounting and auditing practices had permeated English society, it is appropriate to examine not only business organizations, but also agencies in the not-for-profit sector. Did the impetus for accounting in such systems come from government or from business? The excellent work of the archivists of the Society has provided an extensive store of primary documents chronicling its development from its inception in 1701. Because these records are not indexed in detail, we refer to particular documents by title in the body of the paper itself rather than providing extensive references at the end. All referenced documents are now under the care of the Rhodes House Library, Oxford, England, and indexed as the archives of the United Society for the Propagation of the Gospel.

THE SOCIETY

The Society, incorporated under civil authority and subject to the religious authority of the Archbishop of Canterbury, sent missionaries to the expanding British Empire in North America and helped establish a number of libraries in the colonies. Members of the Society were drawn from the more educated members of the Church of England who were concerned about the religious apathy present in the Age of Enlightenment and the problem of an expanding British population in North America. In 1701, for example, there were over 43,000 members of the Anglican communion in the British colonies who were served by only 50 members of the clergy. Efforts to rectify this situation were begun by the Society and continued for over 80 years [Laugher, 1973; Ahlstrom, 1972]. According to one historian,

> [from] 1702, when the first missionary was dispatched, until 1785, when the Society ceased operation in America, 309 clergymen were sent to the colonies, £227,454 was expended in providing libraries and paying salaries, and over 130,000 Bibles, Common Prayer Books, and other works of devotion and instruction were distributed. . . . [Laugher, 1973, p. 63]

Funding for these missionary activities came from membership subscriptions, donations, rents, dividends, bequests, and other varied sources. Supporters included the Archbishop of Canterbury, members of educational institutions, prominent members of the nobility, and colonial governors. The Society was able to raise over £477,000 in the 1700s [Pascoe, 1901].

Approximately four percent of the Society's receipts came from nonmembers. The English Crown issued Royal Letters calling for public collections in the Church of England which were to be utilized for the Society's benefit. In 1779, for example, George III, a contributor himself, issued a Royal Letter to Frederick Lord, the Archbishop of Canterbury, which required that

> our letters be communicated to the several Suffragan Bishops . . . and that,

> upon this occasion, the Ministers in each parish to effectually excite their parishioners to a liberal contribution . . . [and] . . . the sums so collected to be paid immediately to the Treasurer, or Treasurers, for the time being, of the said Society. . . ." [Pascoe, 1901, pp. 824–825]

In order to be able to account adequately for these funds, provide adequate internal control, and engage in thorough planning, both accounting and auditing procedures were adopted by the Society from its earliest years. These procedures and practices are described below.

INTERNAL CONTROL

From its inception, the Society was apparently concerned with methods of internal control. The minutes of the first meeting (June 27, 1701) entitled "The Journall of the Society for Propagating the Gospell in Forreign Parts" (Journal) ordered that a "Seal" be prepared for the Society's use. Because it was organized as a "corporation," the authority to initiate action in the name of the Society was concentrated to those selected to possess its seal.

At this same meeting, treasurers and auditors (two each) were selected. This triad (the seal, treasurer function, and auditor function) formed the basis for an extended system of internal control. This system identified clearly the locus and delegation of authority and emphasized fiduciary responsibility of individuals for physical possession of Society property. Division of functions made it necessary for collusion to accompany miscarriage of Society business.

The second meeting provided specific controls for the disposition of money by the treasurers. Item 5 provided that if a "Sum or Sums of Money exceeding Twenty Pounds" was to be disposed of, all members of the Society known to be in town were to be summoned. Item 6 required a quorum of "Fourteen Members Present" to conduct such dispositions. Item 7 stipulated physical control procedures for handling money, i.e.:

> That all Sums of Money received by the Treasurer or Treasurers upon the Account of the Society should be deposited in the Bank of England; but that nevertheless the Treasurer or Treasurers shall have liberty to deposit any Sum or Sums of Money not exceeding the value of One Hundred Pounds Sterling at one time in the Hands of two Goldsmiths to be Approved of by this Society.

Significant behavioral considerations were built into this system of controls. Item 8 provided "That no Treasurer shall be lyable to make good Losses of an Sum or Sums of Money Deposited in manner aforesaid." Item 9 made each Treasurer responsible only for his own acts, i.e., "That neither of the Treasurers be Answerable for Acts or Miscarriages of the Other." These provisions gave incentives to comply with the security procedure in a timely manner and to maintain personal integrity and, thus, avoid collusion in infidelity.

THE RECORDS

The first specific financial record considered by the Society was a subscription roll. The second meeting of the Society ordered the secretary to prepare this roll to raise money advanced for passing the charter by voluntary subscription of the members. The Journal entry of the third meeting (July 10, 1701) lists members "Paid and Subscribed" and the "Sums" in terms of "£–S–d." The sums are totaled. This list is the first financial schedule of any sort found in the Journal.

Later that year (September 17, 1701), the Society initiated a subscribers' roll to record annual subscriptions. Unlike the special-purpose charter contributions, these subscriptions were annual contracts to contribute specified amounts to the Society. This roll was recorded on a parchment scroll and listed the names of subscribers with their annual contributions from September 17, 1701 to September 16, 1709. In the years following, the entire annual contributions for a particular year were recorded on one large parchment. In this latter format, the annual contributions were recorded in the quarter of receipt. The subscribers' roll functioned as a book of original entry for the contracted contributions to the Society. A benefactors' book served the same purpose for other personal contributions by both members and nonmembers. Accounting events were recorded in it both chronologically and comprehensively.

The treasurers kept the account of the Society from its inception. Whether the account took the form of a continuing record from which reports were drawn periodically or the account was, itself, the report is unclear in the early record. However, by 1750, specific books of account were being maintained on a cash basis by the treasurers. The account represented the historical cash flow of the Society and its balance at any moment represented the liability of the treasurers to the Society. The books were closed annually.

Just beneath the annual closing, a formal statement was entered and signed by the treasurer. This was followed by the signatures of auditors without comment. For example, the January 31, 1759 statement was as follows:

> I, Edward Pearson, Treasurer to the Society for the Propagation of the Gospel in Foreign Parts, do hereby acknowledge Myself indebted the [emblem or abbreviation] Society on this Acct. in the Sum of one hundred twenty five pounds an Shilling & four pence, for which I promise to be accountable on Demand.
>
> Edw. Pearson [signature]
>
> In this area, four additional signatures appear.

By 1805, an auditor's statement had replaced the treasurer's statement:

> We the underwritten Auditors of the Society for the Propagation of the Gospel in Foreign Parts have carefully examined the General Account of the Society and find the Balance due from the Treasurer to be One Thousand Four Hundred and Sixteen Pounds Eleven Shillings and Nine Pence.
>
> Several signatures

Entries into the book of account were backed by a system of bills, receipts, and vouchers. Some of these source documents from the early period (1711–1749) have survived. Apparently, a separate book of original entry for disbursements did not exist and, thus, the source documents drove directly this side of the book of account. On the other hand, the receipts side of the account was driven by Subscriptions and Benefactors' Books.

THE REPORTS

The Treasurer's Reports

As stated above, treasurers were selected at the very first meeting of the Society. It is likely that reports were required of these treasurers from the beginning. Journal entries for the August 20, 1703 meeting of the Society describe the reporting procedures required of the treasurers. Items 3, 4, and 5 state:

> M^{r} Hodges one of the Treasurers produced the Acc,^{ts} of the Society for one year ending att Mid sumer Last, which had been examin'd and signed by two of the Auditors.

> Ordered that the S^{d} Acc,^{ts} do lye upon the Table for the Perusal of the Members.
>
> Ordered that the Secretary do wait upon the L^{d} Keeper and the L^{d} Ch. Justice of the Common Pleas wth two Coppies of S^{d} Accounts.

The Society was required to report annually to the court, so it is likely that in the beginning the accounts (or reports) were presented formally to the Society on an annual basis. However, by 1723, quarterly reports were in use. The Journal entry for November 15, 1723 records the following:

> The Treasurer laid before the Board his Quarterly Acc't to this day whereby it appears he hath in his hand on account of the Society. . . .

The treasurer's reports (accounts) were always on a cash basis and provided the balance as of the date of the report. Two of the early reports (titled accounts) to the High Chancellor survive, i.e., those for the years 1723 and 1730. The 1723 account was written on one piece of parchment about 36 inches square.

Public access to the treasurer's annual reports was available through at least three procedures. These were: (1) the accounting given the court, (2) the physical procedure of laying the accounts before the Society, and (3) the inclusion of the information in the published proceedings of the Society as part of the auditor's report. This latter procedure is discussed in detail in the following section.

The Auditor's Reports

As with the treasurers, auditors were selected at the very first meeting of the Society. Early in its existence, the auditors began to report formally to the Society, probably from the first year of incorporation. The 14th item of the "17 Febry 1709-10" entry to the Journal implies that a formal reporting procedure had been established:

> The Report of the Auditors dated 31st Janry 1709 and signed Francis Nicholson, Henry Shuk, & Vigerus Edwards was read and refer'd to the Committee. . . .

By 1757, the leaders of the Society recognized their increasing reliance upon the work of the auditors with this February 17, 1757 entry:

> The Auditors Report . . . was laid befor the board, & read. . . . Agreed that Thanks of the Society be given to the Auditors for their great care & paine in examining and stating the Accounts to the Society.

The 1711 auditor's report survives. It is written in narrative on eight pages, each approximately six inches wide by twelve inches long. The auditors reported on their examination of and accounting for the following:

1. The persons who collected the subscriptions and turned over the money to the treasurers,
2. The treasurers' accounts,
3. "Taken an account of" the arrears of subscriptions,
4. The tenant of the Society's estate (He was in arrears.),
5. "We have taken a general View of Income & Charges both Certain and Casual,"
6. Debts owed by the Society.

The 1735 statement that is appended directly to the Auditor's report survives. The purpose of this document is clearly identified by the following statement at the bottom of the page:

> 29th January 1735
> This is the Parchment Writing markt, D, mentioned in our Report of this Day.
> (signed by five individuals)

The statement is entitled:

> The General View of the State of the Society and of the Income and Disbursements thereof the 29th day of January 1735 delivered with the Auditors Report of that day.

It contains:

> An Abstract of the Treasurers Account containing neet Receipts and Payments from the 31st day of January 1734 to the 29th day of January 1735.

This statement accounts for the Barbados Estate in a separate section. The net amount of this section is not consolidated into the receipts of the Society sections. The receipts and payments of the Society are summarized in one section with the difference being added to the payments to produce balancing amounts for receipts and payments. A second section provides long lists of detailed "Receipts & Due from," on the one hand, and on the other "Yearly Sal." and "Due at Christmas" categorized by region. A third section distinguishes "Yearly Income," "Casual Income," "Yearly Disbursements," and "Accidental Charges." By 1785, "The General View . . ." termed the "Due at Christmas" column "Arrears." This designation continued until at least 1800. Other changes occurring between 1785 and 1800 were: (1) fine red lines were used to make explicit the left-right columnar format of the statement, and (2) instead of separate accounts, e.g., Barbados Estate and Bishops, being entered in report form, they were entered in account form with "Receipts" in the left column and "Payments" in the right column.

Such reports tied the entire record-keeping and reporting systems together. In the earliest years, an abstract of the treasurer's report may or may not have been part of the statement appended directly to the auditor's report. An entry in "An Abstract of the Proceedings of the Society" dated January 16, 1713 reported the information in the following manner:

First: A summary of the financial dealings related to the Barbados Estate was given. The amount the Society paid for purchases, salaries, etc. was subtracted from an amount labeled "Received 220 Hogsheads of Sugar (100 this Year) all Sold for," to give a net amount labeled "Remaining Cash in Hands of Treasurer."

Second: "We conclude with the Report of our diligent and faithful Auditors, Mr. Tayleure and Mr. Edwards, who, after the examining our Accounts, and the severl Receipts and Payments thereto relating, found that the Balance of 1525 20 2¼ remaining on the last Audit, the Receipts amount to the Sum of 3848 11 1¼ and the Payments, to the Sum of 3052 5 10. and that there remained in cash in the Hands of the Treasurer the 16th of *January* 1713. 796 5 3¼. *viz.*"

Third: This narrative is followed by a financial statement in the following format:

Receipts

"By Annual Subscriptions of Members"
"By Rent"
(etc.)
(total)
"*To which add the Ballance* of the last Account"
"And the same make together"

Disbursements

"By Payment of yearly salaries"
"By Purchase . . ."
(total)
"Remaining"
(Total) This total equals the bottom line of the receipts section

Fourth: "The said Auditors also laid before the Society an Estimate of the Society's perfect Yearly Income and Expense, *viz.*"

Fifth: Yearly Income

"By Annual Subscriptions"
"By Yearly Rent"
(total)

Yearly Expenses

"By Salaries"
(etc.)
(total) The yearly income and expense totals are not equal. Likewise the total income does not equal total receipts, nor does total expense equal total disbursements.

INTERPRETATION OF THE EVIDENCE

The auditor's reports reflect both the attest and the managerial accounting functions. In these functions, the auditors play a dual role which welds the separate parts of the accounting system into a cohesive whole that provides useful information about an identifiable accounting entity. In the following sections, we discuss the relation between the Society's attest and managerial functions and those that were common in business entities during the period.

The Attest Function

The Society directed its auditors to perform the first attest function during its first meeting (1701), i.e.:

> Order'd that the two Auditors and M^{r} Bulstrode do meet on Monday next at 4 in the Afternoon at M^{r} Brewster's cham . . . to consider of the Bills of the Charges for Passing the Cha . . . this Society, and make their Reports at the next Meeting.

That the auditors are involved in an attest function is shown by the different kinds of reports submitted by the parties. At the second meeting of the Society,

> D^{r} Woodward [one of the first auditors] reported that he and M^{r} Bulstrode had considered the Bills of the Charges for passing the Charter and had approved of the Several Articles, but had come to no Resolution about the Reward to the Sollicitors.

At the third meeting, Mr. Brewster reported that Dr. Bray and he (neither were auditors) had considered the bill of charges, listing each charge with description and totaled the list. Mr. Brewster clearly submits the substantive report and the audit report attests to its acceptability. In this instance, the attest function precedes the report and payment of the charges. In this arrangement, the attest function is similar to a continuous internal control procedure related to, and perhaps anticipative of, a voucher system. Whether or not this particular procedure persisted is not clear.

In its February 27, 1701–1702 meeting, the Society first commanded that an audit of an account be performed. Dr. Bray moved that a committee be appointed to audit his accounts relating to the charges of his "Missions into the Plantations." It was ordered that the audit be done and a committee was selected. None of the three auditors that the Society had selected to serve that year were appointed to the committee. At the "6 Martz 1701/2" meeting, the committee reported that the work was done and it was ordered that the report, along with Dr. Bray's accounts, be laid before the Society at the next quarterly meeting. The absence from this committee of the Society's appointed auditors may imply that the function of the Society auditors was rigidly restricted to the accounting entity identified as the Society.

It is likely that the auditors attested to the acceptability of the treasurer's reports from the beginning. The 1703 Journal entry (quoted above) indicates that the auditors examined and signed the treasurer's account. Item 2 of the 1711 auditor's report states that the auditor examined the treasurer's account. The formal statements at the closing of the books of account in 1759 and 1805 (quoted above) both indicate that the auditor attested to the acceptability of the books of account.

An audit trail, no doubt, existed and is evidenced by the auditor's involvement with the source documents of the charter transaction (discussed above) and the survival of some source documents from the period 1711–1744. Furthermore, Items 1 and 2 of the 1711 auditor's report indicates that the auditors also attested to the acceptability of the records of the persons who collected the subscriptions, of transfers made to the treasurers, and of payments made by the treasurers. The phrase in the 1713 Proceedings (quoted above), "After examining our Accounts, and the several Receipts and Payments thereto relating," strongly implies that the auditors did not merely determine the accuracy of the accounts, but also confirmed that the described process had occurred. The transfers involve an internal audit trail and the confirmation of payments is an example of the audit trail extending beyond the boundary of the Society.

Items 3, 4, and 8 of the 1711 Auditors' Report, if taken in the context of various descriptions in the record of auditor activities, indicate that independent confirmation of receivables and payables was made by the auditors. The auditor created a record of the arrears of subscriptions as part of their working papers used to confirm the record of subscriptions. The subscription liability was confirmed by examination of subscriber-signed documentations or the actual testimony of subscribers. Payments made by treasurers were confirmed in a similar manner. This procedure extended the audit trail beyond the accounting system itself in much the same manner as the procedures used today.

Watts and Zimmerman [1983] examine English business corporations from about 1200 to 1844. They conclude that "the existence of the independent auditor is not the direct result of government fiat" [p. 633], but rather gradually developed over this period. The "evidence suggests that monitoring of performance is important, if not crucial, to the formation of firms. The long survival of auditing suggests it is part of the efficient technology for organizing firms" [p. 614].

The archival record of the Society supports the Watts and Zimmerman conclusion that auditing is part of the efficient technology for organizing firms. We found no evidence that the government imposed auditing on the Society. On the contrary, if such a requirement existed, surely the auditors would have signed the annual report submitted to the court by the treasurer. They did not.

However, because the Society cannot be characterized as a business (some part of a profit/market system), the record suggests that the Watts and Zimmerman hypothesis may be extended to organizations such as governmental, eleemosynary, and religious organizations. Indeed, the hypothesis may be generalizable to all organizations containing multi-echelon decider/management systems. This proposition is supported by evidence presented by Sombart [Most, 1979, p. 248] that the city state of Venice (a governmental organization) required monthly audits and surprise cash checks as early as the 13th century. The Watts and Zimmerman hypothesis does not assert origin and the origin of auditing may be found much earlier than the period when business firms emerge. This is supported by Chatfield [1974, p. 112], who relies on Fitzpatrick [1939], to assert that primitive royal audits had been conducted as early as 1100 A.D. and were "designed to verify the honesty of persons charged with fiscal responsibilities."

Nevertheless, it is likely that the audit technology achieved by business firms provided the immediate impetus for development of auditing within the Society. Watts and Zimmerman cite evidence that some persons were members of both regulated companies and companies of merchants [p. 620] and during the 18th century, merchants often served on the audit committees of several companies [p. 625]. Such patterns may explain how business auditing could influence the Society. Its members included the elite of English society—those who had religious, political, and business understanding. The possibility of a member serving both the Society and a firm in an audit capacity and the similarity between the Society's audit methods and that of businesses of the period suggest that the Society's audit procedures were adapted from business audit procedures.

According to Watts and Zimmerman, the business audit environment during the 18th century included: (1) incentives for auditors to be independent, (2) sizes and compositions of audit committees that reflected differences in firms by size and the types of agency expressed within firms, (3) annual election of auditors, (4) auditing of the treasurer's accounts—both general and those in other towns, and (5) audit reports to members of the firm (e.g., shareholders in joint stock companies). These traditions had grown up in England since the Middle Ages [Chatfield, 1974; Brown, 1968; Littleton, 1933; and Littleton and Yamey, 1956], and were generally followed by the Society as described above.

While the auditing methods used by the Society were similar to those used by business firms, they were imposed on a significantly different legal entity. The business firms were comprised of owners who might incur debt obligations to outsiders. The Society consisted of members who by their annual subscriptions incurred debt obligations to the corporate body, the Society. It is possible that such eleemosynary organizations provide an important connection between audit functions that monitor fiduciary relations and those that attest to debt relations.

The Managerial Accounting Function

Items 3, 4, 5, and 7 of the 1711 Auditors' Report provide evidence of a managerial accounting function of the auditors. Taking an account of the arrears of subscriptions (Item 3) obviously makes it possible for management to take some action to collect them. If no such action were contemplated, subscriptions would simply be acknowledged and recorded at the moment of receipt. Similar observations can be made about the rent receivable from the tenant (Item 4) and the debts owed by the Society (Item 7).

Item 5 brings up an interesting issue. It states:

> We have taken a general View of Income & Charges both Certain and Casual.

Does this reference describe incipient accrual accounting methods in the Society? The "Income & Charges" clearly do not refer to the receipts and disbursements of the Society. The accrual recording of subscriptions was used from the beginning. The first financial schedule [10 July 1701, Journal] is captioned "Members Paid or Subscrib'd." However, only the paid subscriptions were reported as receipts to the court. Income and receipts were distinguished one from the other and the income record was used for internal managerial purposes. Likewise, disbursements and charges or expenses were recognized as different information—the cash flow data for external and fiduciary reporting, the accrual-characterized data for managerial reporting.

The January 1713 Abstract of Proceedings (described above) provided an "Estimate of the Society's perfect Yearly Income and Expense." By 1722, the yearly income and expense was no longer described by the term "estimate." The income included both received and accrued subscriptions of members, rent of land, interest on securities, and contributions by both living benefactors and the estates of those deceased. Expenses included paid and accrued salaries, book purchases, and "other accidental charges." The "General View" of 1735 (described above) presents both cash and accrual information. However, it does not directly reconcile the two. While there is extensive evidence of accruals, we found no evidence of the use of deferrals.

Winjum [1972] examined the extant accounting records of English businesses from sole proprietorships to the East India Company from 1500 to 1750. He observed that "the precise determination of enterprise income, with its associated concepts of periodicity, deferrals, and accruals, was not achieved. . . . Other objectives, such as the desire for a complete accounting record, the need to exercise control over a particular operation or investment, or considerations of bookkeeping procedures, took precedence . . ." [Winjum, 1972, p. 243]. Yamey et al. confirm that there was "neglect of what today is called accrual accounting . . ." [1963, p. 193].

The objectives of accounting observed by Winjum among English businesses of the period are revealed in the records of the Society as well. In addition, the Society exercised the concept of periodicity and achieved forms of accrual. Furthermore, the determination of precise income was a persistent objective. While the concept of income in the modern sense was not fully formulated, the Society did recognize the difference between cash flow and income realization.

In addition to rudimentary accrual accounting, the auditor's managerial accounting function included providing predictive or budget-type information. The 1732 abstract of the proceedings of the Society, published in *A Sermon Preached* . . . states:

> The Auditors of the Society, in the Examination of their Accounts, have observed to the Society, that their *Disbursements by Payment of yearly* Salaries to Missionaries, Catechists, Schoolmasters, & c. supplying them with large Quantities of Books, proper and useful in their missions, and other *accidental Charges*; do always exceed their *certain yearly Income*; which arises by the Sub-

> scription of the Members, Rent of Lands, and by Monies laid out in Securities, in a very considerable Sum; but that this deficiency hath through the good Providence of God been hitherto supplied by Benefactions and Legacies, *occasionally given* to the Society by well-disposed Persons. [emphasis added]

During the mid-century period, the auditors used certain idioms to consistently distinguish between income on the basis of expectancy. In the context of the period's entire record, the idiom "certain yearly Income" identifies normal, recurring revenues on which plans can be made; while "occasionally given" indicates nonrecurring, unexpected revenues. A similar distinction is made between "Disbursements by Payment of yearly" and "accidental Charges." There is no evidence, however, that the auditors projected the following year's statements.

The membership subscriptions roll and the yearly salaries list were apparently used as budgeting tools. In fact, the 1735 "General View . . ." formats the salaries list and the "Due at Christmas" list in a manner that may anticipate the appropriation-type imposition of budget information on the accounts. At the same time, it may suggest that managerial accounting for the timely payment of legal debts is in place.

This evidence of progressive support of internal management needs (budgeting and control) as the Society grew is consistent with the findings of Watts and Zimmerman [1983], that auditing emerged in the accounting information systems of commercial organizations as the result of internal needs rather than external pressures of law. Most [1972] makes a similar assertion for public sector organizations and presents evidence "that accounting was not the product of 'the period of early capitalism' but was, in fact, introduced into the public sector much earlier in time, for planning and control purposes" [p. 732]. Governmental and eleemosynary organizations have similar inputs and outputs. A critical difference between governments and charities is that the former conscripts receipts while the latter must entice them. This difference may explain the Society's use of rudimentary accrual and budgeting to determine continuing or expected receipts.

CONCLUSION

The archival records of the Society are extensive and may be a useful primary source for in-depth studies of the role of not-for-profit agencies in the development and application of accounting conceptual procedures in 18th century England. We believe that the evidence we discuss suggests the following:

1. The immediate impetus for auditing in the Society came from business and not from government.
2. Rudimentary managerial accounting procedures emerged in the Society as a result of internal needs for planning and control in much the same way they were emerging in businesses of the period.
3. The hypothesis that auditing is part of the efficient technology for organizing firms might be generalized to include eleemosynary and religious organizations as well.

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The Influence of Estimation Period News Events on Standardized Market Model Prediction Errors

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ABSTRACT: In many accounting and finance research studies it is hypothesized that the news release under study has valuation implications. Results often indicate that the distribution of risk adjusted residual common stock returns, conditional on the occurrence of a wide variety of specific news event types, differs in one or more moments from the distribution of returns when such events are absent. This paper demonstrates that the distribution of *Wall Street Journal* news-conditional residual returns differs from the distribution of returns when such news is absent. A "news-conditional" model of the process generating security returns is proposed as an alternative to models typically used in previous event studies. Standardized prediction errors and squared standardized prediction errors from the news-conditional model are compared with those generated by conventional procedures.

MANY research studies in accounting and finance focus on relations between particular news release types (e.g., earnings, dividend, and merger announcements) and contemporaneous changes in security prices. In the typical study, it is hypothesized that the news release under consideration has valuation implications. Results reported in many of these studies indicate that the distribution of risk adjusted residual common stock returns, conditional on the publication of a variety of specific news events in *The Wall Street Journal*, differs in one or more moments from the distribution of returns when such events are absent.

Based on an analysis of firm-specific news reported in the 1983 *Wall Street Journal Index* for firms listed on the CRSP Daily Returns file, this paper demonstrates that the distribution of *Wall Street Journal* news-conditional residual returns differs from the distribution of returns when such news is absent.

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This finding leads us to propose a "news-conditional" model of the process generating security returns as an alternative to models typically used in previous event studies. Results presented below indicate that standardized prediction errors and squared standardized prediction errors from the news-conditional model tend to be larger in absolute value than those generated from a "conventional" market model.

Section I presents evidence, based on 1983 data, that "news" and "no-news" security returns distributions differ. In Section II, the news-conditional model is developed. Section III compares the asymptotic properties of conventional parameter estimates and standardized prediction errors with those of the news-conditional model. Section IV examines empirical characteristics of the news-conditional model and a conventional market model. Because of the costs of identifying news release dates, we examine whether models conditioned only on earnings and dividend announcements, which are available at relatively low cost, provide similar results. Section V reports these comparisons. Concluding remarks appear in the final section.

I. NEWS AND SECURITY RETURNS

In many empirical studies, it is assumed that stock returns follow a stationary multivariate normal distribution. If this condition obtains, the time series of returns to a particular security can be represented as a conventional "market model" of the form:

$$r_t=\alpha_c+\beta_c r_{mt}+\epsilon_t \qquad (1)$$

where r_{mt} is the market return in period t. The subscript c denotes conventional "market model" coefficients; it is introduced here for consistency with notation used in subsequent sections. The unconditional distribution of ϵ_t is normal with zero mean and variance σ^2.

In statistical tests, ϵ_t is often assumed under the null hypothesis to be independently and identically distributed across time. The results of many previous studies of the relation between firm-specific news and security returns contradict this assumption. For example, Beaver [1968] demonstrates that residual returns during the week of annual earnings announcements have higher variance than returns during weeks with no earnings announcements. Despite this evidence, many empirical studies continue to assume that $\epsilon_t \sim IID$ for modelling and testing purposes.

In order to examine the empirical distribution of ϵ_t, daily security return residuals were calculated for all firms listed on the New York or American Stock Exchange during 1983. Each element of the residual series for a firm was then standardized using the estimated standard deviation for that series. For each firm, two-day standardized residuals were calculated for the day of and the trading day preceding publication for all firm-specific news items listed in the *Wall Street Journal Index*. For comparison, the remaining consecutive pairs of single day residuals were aggregated to form two-day standardized residuals.

Figures 1 and 2 and Table 1 present the distributions of 34,067 "with-news" and 242,482 "no-news" two-day standardized residuals for 2,337 firms during 1983. The residuals in Figure 1 are calculated using the CRSP equal-weighted index; those in Figure 2 are based on the CRSP value-weighted index. Each figure shows marginal and cumulative frequency distributions. Both figures indicate that the variance of with-news residuals (indicated with solid lines) exceeds that of no-news residuals (indicated with broken lines). A Kolmogorov-Smirnov

FIGURE 1

DISTRIBUTION OF STANDARDIZED TWO-DAY RESIDUAL RETURNS
USING MARKET MODEL WITH EQUAL-WEIGHTED INDEX

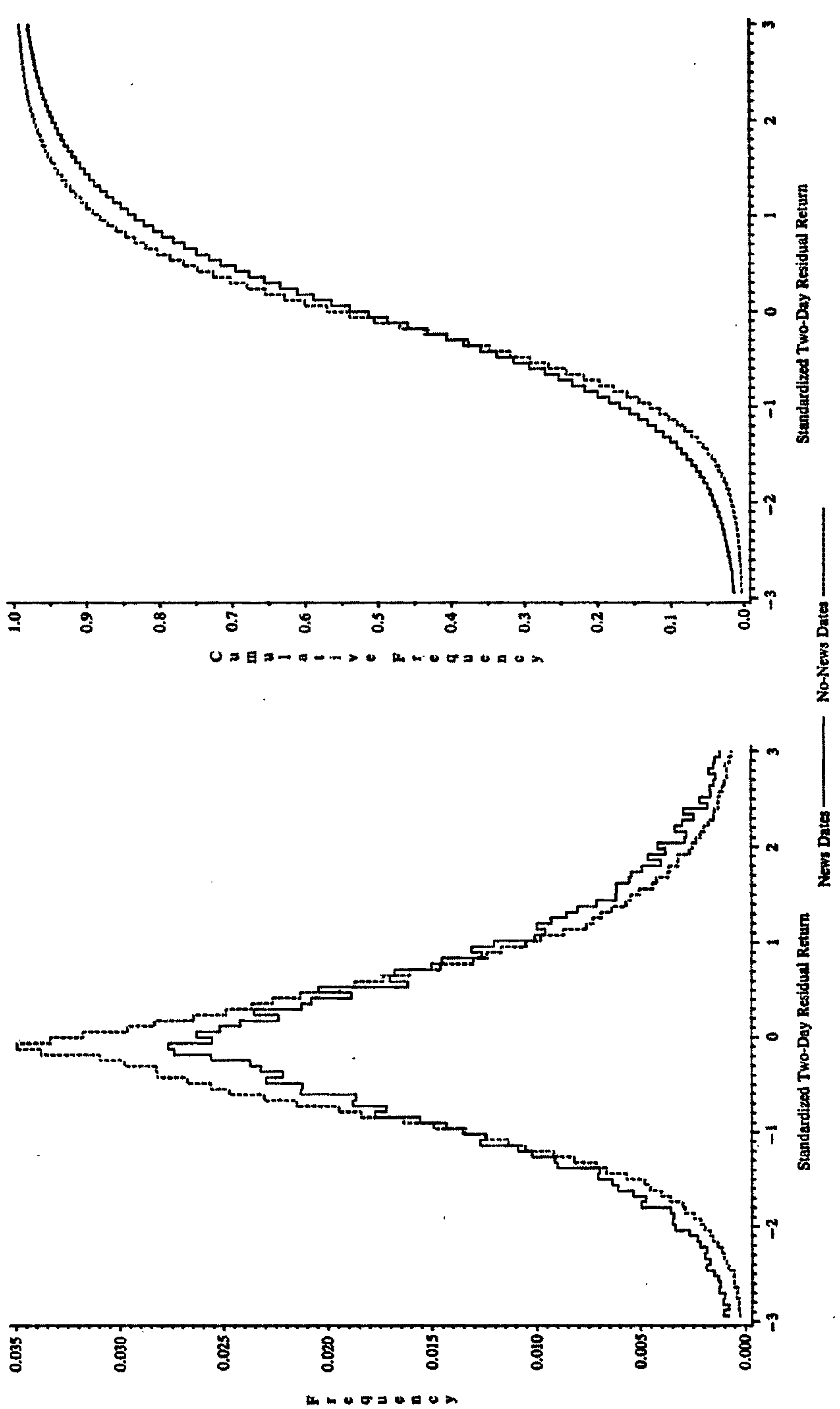

FIGURE 2

DISTRIBUTION OF STANDARDIZED TWO-DAY RESIDUAL RETURNS
USING MARKET MODEL WITH VALUE-WEIGHTED INDEX

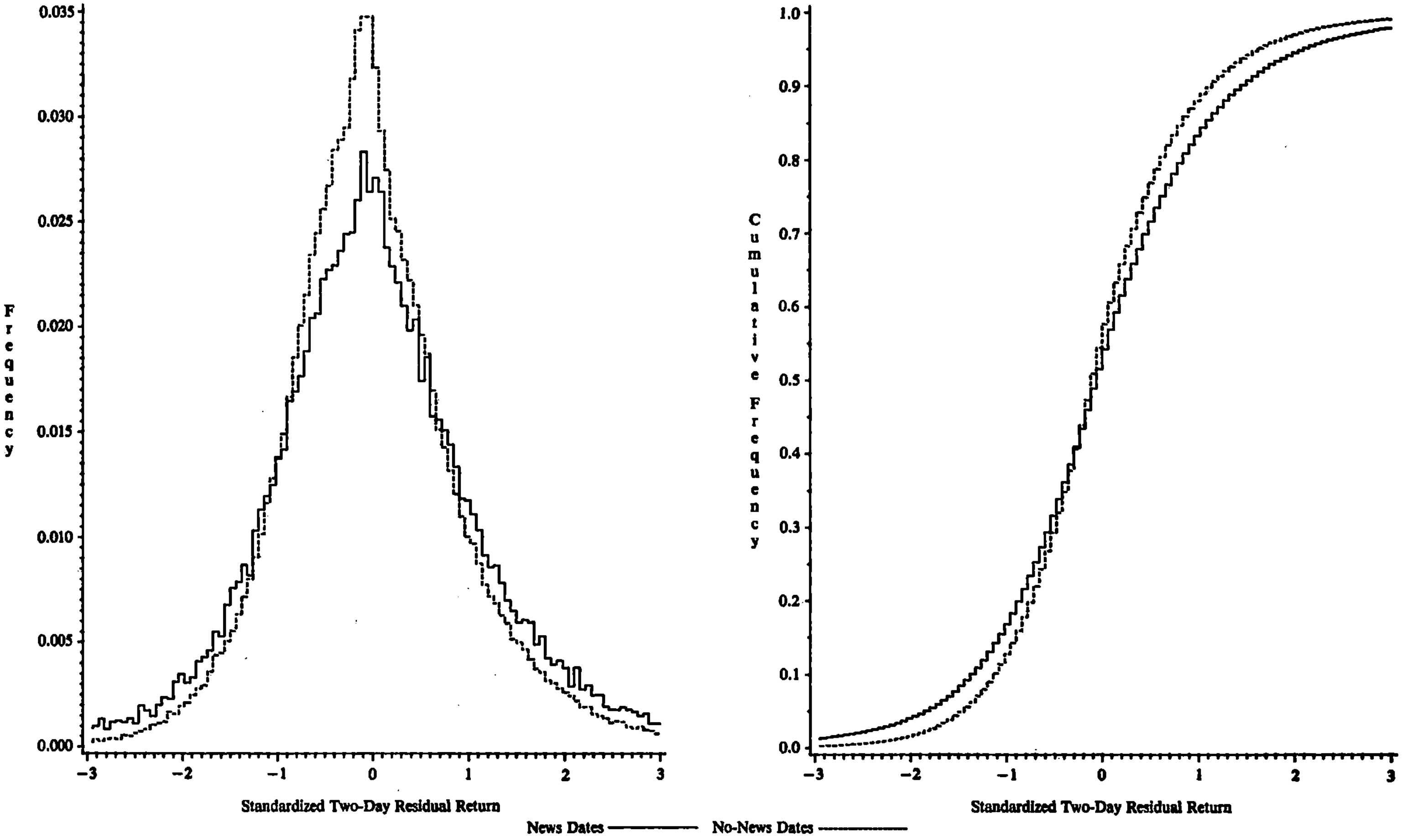

TABLE 1

FREQUENCY DISTRIBUTION OF STANDARDIZED TWO-DAY RESIDUAL RETURNS DURING WITH-NEWS AND NO-NEWS PERIODS BASED ON 1983 *Wall Street Journal Index* NEWS ITEMS

	Equal-Weighted Index		*Value-Weighted Index*	
Range of Standardized Residual Return	*With-News (Percent)*	*No-News (Percent)*	*With-News (Percent)*	*No-News (Percent)*
less than −3.0	1.2	0.2	1.2	0.2
−3.0 to −2.5	0.9	0.3	0.9	0.3
−2.5 to −2.0	1.8	1.0	1.8	1.0
−2.0 to −1.5	3.9	2.8	3.8	2.8
−1.5 to −1.0	8.3	7.6	8.3	7.5
−1.0 to −0.5	14.7	16.5	15.0	16.6
−0.5 to 0	20.6	25.4	20.6	25.9
0 to 0.5	18.9	21.5	19.0	21.2
0.5 to 1.0	12.6	12.3	12.4	12.1
1.0 to 1.5	7.3	6.1	7.2	6.1
1.5 to 2.0	4.2	3.1	4.2	3.1
2.0 to 2.5	2.3	1.5	2.3	1.5
2.5 to 3.0	1.3	0.8	1.3	0.8
greater than 3.0	2.0	0.9	2.1	0.9
Mean Standardized Return Residual	.03610	−.00500	.03258	−.00758
Standard Deviation	1.255	0.956	1.259	0.960
t-statistic	5.309	−2.575	4.778	−3.888
F-ratio of With-News to No-News Variance	1.72		1.72	

Standardized residual returns are calculated as follows:

Step 1—For each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, estimate α_c, β_c, and s_c^2 using all available returns during 1983:

$$r_t=\hat{\alpha}_c+\hat{\beta}_c r_{mt}+\epsilon_t$$

Step 2—Calculate residuals for all trading days:

$$\hat{\epsilon}_t=r_t-(\hat{\alpha}_c+\hat{\beta}_c r_{mt})$$

Step 3—Calculate standardized residual for each trading day:

$$v_t=\hat{\epsilon}_t / s_c$$

Step 4—Aggregate two-day standardized residuals for the day of and the trading day preceding publication for all firm-specific news items listed in the *Wall Street Journal Index*:

$$v_r=(v_r+v_{r-1}) / \sqrt{2}$$

Step 5—Aggregate remaining single day residuals to form two-day standardized residuals if residuals were for consecutive no-news days.

two-sample test rejects the hypothesis that the with-news and no-news distributions are identical at the .001 level. The absolute values of all *t*-statistics are greater than 2.5 and the *F*-ratio of with-news variance to no-news variance (1.72) rejects the hypothesis of equal variance at the .001 level. Further, the table indicates that with-news residuals are positive, on average, while no-news residuals are negative. This result, which relies on all 1983 *Wall Street Journal Index* news items, is consistent with that of Chambers and Penman [1984] for announcement and non-announcement periods surrounding earnings releases.

Because the with-news distribution appears to be different than the no-news distribution, empirical tests should consider which distribution is appropriate in conducting statistical tests in a typical event study. Most event studies use a statistic that compares returns during "event" and "estimation" periods for a cross section of affected firms without regard to firm-specific news releases during the estimation period (for exceptions see McNichols and Manegold [1983] and Patell and Wolfson [1981]). Returns outside the event period are used to estimate the parameters of a returns generating process for each firm in the cross section. These estimates are used to form expectations for returns during the event period itself. Deviations from expectation during the event period are then aggregated to form a test statistic which is interpreted as an index of the strength of association between price change and news release. The null hypothesis implicit in such studies can be stated as follows:

> (Type A)
> The distribution of security returns for periods in which category-η news events are present does not differ from that for periods in which category-η news events are absent.

Because the distribution of returns during with-news periods differs from that during no-news periods, a second form of null hypothesis can be considered:

> (Type B)
> The distribution of security returns for periods in which category-η news events are present does not differ from that for periods in which firm-specific news releases are absent.

This form of null hypothesis increases the probability of rejection when the no-news distribution has lower variance than the return variance conditioned only on the absence of category-η news events. Statistical tests will also be affected if these distributions have different means. Sections II and III describe a news-conditional model for testing hypotheses of Type B; Section IV examines the empirical characteristics of the news-conditional model relative to the conventional market model.

II. NEWS-CONDITIONAL MODEL

Assume that the market model (equation (1) above) obtains during periods of no firm-specific news release. During periods of news release, assume that returns are augmented by random amounts $\delta + w$, where δ is some constant and w is distributed normally with zero mean and variance σ_w^2. Further, assume that a T-period estimation time series of security returns includes T_2 periods of news release and $T_1(=T-T_2)$ non-release periods. Under these conditions, a reasonable *ex post* characterization of the market model would be:

$$r_t = \begin{cases} \alpha + \beta r_{mt} + z_t & \text{[non-release periods]} \\ (\alpha+\delta) + \beta r_{mt} + (z_t + w_t) & \text{[news release periods]} \end{cases}$$

or, in matrix notation,

$$R = XB + u, \qquad (2)$$

where

R = a $T\times 1$ vector of security returns (r_t);
$X = [1\ M\ D]$;
1 = a $T\times 1$ unit vector;
M = a $T\times 1$ market returns vector (r_{mt});
D = a vector consisting of T_1 zeros and T_2 ones, representing the presence or absence of a news release;
$B = [\alpha\ \beta\ \delta]'$;
α = the market model intercept during "no-news" periods;
β = the market model slope parameter;
δ = the return response associated with estimation period news releases; and
u = a zero mean disturbance vector.

If the disturbances z_t and w_t are assumed to be independent, u_t has variance σ_z^2 during non-release periods and $\sigma_z^2+\sigma_w^2$ during news release periods. Without loss of generality, R, X, and u can be arranged so that the first T_1 and last T_2 rows correspond to periods without and with news releases. The $T\times T$ covariance matrix for u can then be written as:

$$E(uu') = \sigma_z^2 \begin{bmatrix} 1 & & & & \\ & \ddots & & & \\ & & 1 & & \\ & & & \Delta & \\ & & & & \ddots \\ & & & & & \Delta \end{bmatrix} = \sigma_z^2\Omega \quad (3)$$

where $\Delta = (\sigma_z^2+\sigma_w^2)/\sigma_z^2$ and all off-diagonal elements are zero.

In the discussion below, it is assumed that plim $T^{-1}X'u = 0$, and that plim $T^{-1}X'X = \Sigma_{xx}$, a positive definite matrix of finite moments. It is also assumed that the elements of M have constant expectation μ_M and variance σ_M^2, reflecting both the assumption of stationary returns and the additional assumption that the release of news concerning any particular firm has a purely negligible impact on aggregate return (r_{mt}). Finally, for large T, the ratio T_2/T is assumed to converge to μ_D, the latter being interpretable as the news release frequency for the firm in question.

III. Comparison of Conventional Standardized Prediction Errors with News-Conditional Standardized Prediction Errors

Because the returns generating process represented by equation (2) is heteroscedastic, best linear unbiased parameter estimates can be obtained (at least under ideal conditions) using generalized least squares procedures. The appropriate GLS parameter estimates, $\hat{B}$ and s^2, together with the relevant standardized prediction error, V_τ, can be expressed as follows:

$$\hat{B} = (X'\Omega^{-1}X)^{-1}(X'\Omega^{-1}R) \quad (4a)$$

$$s^2 = (T\text{-}3)^{-1}[R - X\hat{B}]'\Omega^{-1}[R - X\hat{B}] \quad (4b)$$

$$V_\tau = \frac{r_\tau - x_\tau\hat{B}}{s[1 + x_\tau(X'\Omega^{-1}X)^{-1}x_\tau']^{1/2}} \quad (4c)$$

In equation (4c), r_τ and $x_\tau = [1\ \ r_{m\tau}\ \ 0]$ are data for some "event period" τ which is distinct from the estimation period. The third element of x_τ is set to zero in order to reflect the null hypothesis that the event of interest has no valuation implications or "information content." It can be shown (see Appendix) that these expressions converge in probability to:

$$\text{plim } \hat{B} = B \quad (5a)$$

$$\text{plim } s^2 = \sigma_z^2 \quad (5b)$$

$$\text{plim } V_\tau = \frac{u_\tau}{\sigma_z} \quad (5c)$$

In order to compare these results to those produced by conventional estimation procedures, first note that equation (2) can be partitioned as:

$$R=[X_c\ D][B_c'\ \delta]'+u \qquad (6)$$

where $X_c=[1\ M]$ and $B_c'=[\alpha\ \beta]$. Conventional market model estimation (equation (1)), and conventional standardized prediction errors (hereafter $V_{c\tau}$) make use of parameter estimates based solely on R and X_c, i.e.;

$$\hat{B}_c=[X_c'X_c]^{-1}X_c'R \qquad (7a)$$

$$s_c^2=(T\text{-}2)^{-1}[R-X_c\hat{B}_c]'\ [R-X_c\hat{B}_c] \qquad (7b)$$

$$V_{c\tau}=\frac{r_\tau-x_{c\tau}\hat{B}_c}{s_c[1+x_{c\tau}(X_c'X_c)^{-1}x_{c\tau}']^{1/2}} \qquad (7c)$$

In equation (7c) r_τ and $x_{c\tau}=[1\ r_{m\tau}]$ are data for "event period" τ. These expressions (see Appendix) converge in probability to:

$$\begin{aligned}\text{plim } \hat{B}_c&=B_c+\delta\Gamma\\ &=[\alpha+\delta(\mu_D-\gamma_2\mu_M)\\ &\qquad\beta+\delta\gamma_2] \qquad (8a)\end{aligned}$$

$$\begin{aligned}\text{plim } s_c^2&=(1-\mu_D)\sigma_z^2+\mu_D\Delta\sigma_z^2\\ &\quad+\delta^2\{\mu_D(1-\mu_D)\\ &\quad-\gamma_2^2\sigma_M^2\} \qquad (8b)\end{aligned}$$

$$\begin{aligned}\text{plim } V_{c\tau}&=\{u_\tau-\delta(\mu_D+\gamma_2(r_{m\tau}-\mu_M))\}/\\ &\quad\{(1-\mu_D)\sigma_z^2+\mu_D\Delta\sigma_z^2\\ &\quad+\delta^2(\mu_D(1-\mu_D)\\ &\quad-\gamma_3^2\sigma_M^2)\}^{1/2} \qquad (8c)\end{aligned}$$

where, in addition to parameters already defined, $\Gamma=[\gamma_1\ \gamma_2]$ is the coefficient vector from a regression of D on M.

To place these results in perspective, recall that the typical event study's purpose is to determine whether significant price revisions are closely associated with the release of a particular type of news. If this notion is operationalized using a Type A null hypothesis, conventional market model parameter estimates and standardized prediction errors are appropriate. On the other hand, if the researcher wishes to test a potentially more powerful Type B null hypothesis, a news-conditional market model such as equation (2) provides explicit control for news releases occurring during the estimation period. A comparison of equations (5) and (8) suggests that, in the Type B case, conventional market model parameter estimates and standardized prediction errors will in general be biased *relative* to those produced by the news-conditional market model.

As indicated in equation (5c), given sufficient resources for parameter estimation, the news-conditional standardized prediction error converges to u_τ/σ_z, a standard normal form representing the ratio of the true event period disturbance to the characteristic "size" of the disturbance during periods which are free of news releases. Inspection of equation (8c), on the other hand, shows that $V_{c\tau}$, the conventionally calculated standardized prediction error, will converge to u_τ/σ_z only at the endpoints of the news release frequency spectrum, i.e., at ($\mu_D=\delta=0$, $\Delta=1$) and ($\mu_D=\Delta=1$, $\delta=0$). In the former case, the firm in question receives no news coverage and is, thus, irrelevant in an event study context. In the latter case, news coverage occurs in every period, and there is no distinction between Type A and Type B null hypotheses. In all intermediate cases, however, conventionally calculated standardized prediction errors include a potentially complex bias.

The nature of the bias depends on the extent to which the security return and return variance are affected by the release of news (i.e., on δ and Δ); on the frequency of news release (μ_D); on the degree of association between market return and the release of news (γ_2); and finally on the degree to which the event period market return is "abnormal" $(r_{m\tau}-\mu_M)$.

In econometric terms, the overall bias in $V_{c\tau}$ can be assigned to two sources. First, an "omitted variables" bias in the estimation of α and β accounts for the presence of the second term in the numerator of equation (8c), and also for the final term within the outer brackets of the denominator. The numerator effect arises because biased coefficient estimates are used to calculate the prediction error itself, and the denominator effect because biased estimates are used to calculate s_ε^2, the conventional market model residual variance. Second, conventional estimation procedures ignore the heteroscedasticity which is present (*ex post*) in the returns generating process. As a result, the first two terms within the outer brackets of the denominator, which represent a weighted average of non-news and news release error term variances, will differ from σ_z^2. If Δ exceeds one, as has been supposed, the weighted average will exceed σ_z^2. This means that even in the absence of the omitted variables problem mentioned above, $V_{c\tau}$ should exhibit a bias toward zero.

Substantial complexity is eliminated from equation (8c) if one is willing to make further simplifying assumptions. For instance, one might argue that the likelihood that a news release occurs for a particular firm during a particular period is unrelated to market return behavior during the same period. In this case, which seems plausible at least for short periods such as daily returns, σ_{MD}, and therefore γ_2, are zero, and equation (8c) reduces to:

$$\operatorname{plim} V_{c\tau}=\{u_\tau-\delta\mu_D\}/\{(1-\mu_D)\sigma_z^2+\mu_D\Delta\sigma_z^2+\delta^2\mu_D(1-\mu_D)\}^{1/2} \tag{9}$$

Here the denominator of $V_{c\tau}$ is biased upward. The numerator is biased downward for positive δ, and upward for negative δ. Thus, the bias in the statistic itself depends on both the sign of u_τ and on the sign of δ. Four cases involving non-zero u_τ can be distinguished:

(a) $u_\tau<0$, $\delta\leq 0$—$V_{c\tau}$ is biased toward zero;
(b) $u_\tau<0$, $\delta>0$—bias in $V_{c\tau}$ is indeterminate;
(c) $u_\tau>0$, $\delta<0$—bias in $V_{c\tau}$ is indeterminate;
(d) $u_\tau>0$, $\delta\geq 0$—$V_{c\tau}$ is biased toward zero.

Finally, if δ is assumed to be zero (corresponding to the belief that, on average, news releases have a neutral effect on returns), then equation (9) becomes:

$$\operatorname{plim} V_{c\tau}=\frac{u_\tau}{\{(1-\mu_D)\sigma_z^2+\mu_D\Delta\sigma_z^2\}^{1/2}} \tag{10}$$

In this special case, no omitted variables problem exists, and $V_{c\tau}$ is biased toward zero.

IV. NEWS-CONDITIONAL AND CONVENTIONAL MARKET MODELS: ANALYSIS AND COMPARISON OF EMPIRICAL CHARACTERISTICS

This section reports news-conditional and conventional market model estimation results, based on 1983 data, for 2,310 New York and American Stock Exchange firms. Distributions of parameter estimates for the two models are summarized and compared. Each model is then used to calculate standardized prediction errors and squared standardized prediction errors for 33,994 1983 *Wall Street Journal* news events. Because these prediction errors are the basic components of cross-sectional test statistics in many event studies, a comparison of their distributions is provided and differences are documented.

Data Sources and Estimation Procedure

Daily stock returns were obtained from the Center for Research on Security Prices (CRSP) Daily Returns File. Data reflecting the incidence of firm-specific news events were obtained from a database (described in Thompson, Olsen, and Dietrich [1987]), which categorizes *Wall Street Journal Index* corporate news items. Both of these sources are limited to New York and American Stock Exchange firms, and the latter provides data only for calendar year 1983. Thus, the initial sample of firms considered in this study included 2,358 NYSE/ASE firms (a) whose common stock was traded during 1983, and (b) for which at least one news item was listed in the "Corporate News" section of the 1983 *Wall Street Journal Index* during the 1983 trading interval.

Where sufficient returns data were available, four market model regressions were estimated for each firm in the initial sample:

a. a conventional market model (equation (1)) based on all available 1983 daily returns [OLS estimation],
b. a conventional market model based on all 1983 "with-news" returns [OLS estimation],
c. a conventional market model based on all 1983 "no-news" returns [OLS estimation],
d. a news-conditional market model (equation (2)) [GLS estimation].

Since some event studies use an equal-weighted return and others a value-weighted return to represent the time series $\{r_{mt}\}$ for market model estimation, each of these regressions was estimated using both the CRSP Equal-Weighted and Value-Weighted indices.

For estimation purposes, a return was termed "no-news" if the return date was neither the day of nor the trading day preceding a *Wall Street Journal Index* news item for the company in question. All other returns were characterized as "with-news" returns. This characterization of with-news and no-news returns ignores other sources of firm-specific news and other news that may be of interest to investors. However, *The Wall Street Journal* represents a major source of news for the financial community, and is often used by researchers to identify information events.

A minimum of 30 daily return observations was required for regressions (a) and (d), and a minimum of three observations was required for regressions (b) and (c). Forty-eight firms not meeting these requirements were eliminated from the initial sample. Thus, the results reported below are based on a final sample of 2,310 firms.

Regressions (b) and (c) provide an estimate of the parameter Δ (see equation (3)) for use in subsequent estimation of the news-conditional model. This estimate ($\hat{\Delta}$) was calculated for each firm as the ratio of the sample residual variance from regression (b) to the sample residual variance from regression (c). Thus, in the case of regression (d), the inverse covariance matrix Ω^{-1} was estimated as:

$$\hat{\Omega}^{-1} = \begin{bmatrix} 1 & & & & & \\ & \cdot & & & & \\ & & 1 & & & \\ & & & \hat{\Delta}^{-1} & & \\ & & & & \cdot & \\ & & & & & \hat{\Delta}^{-1} \end{bmatrix} \tag{11}$$

Conventional and News-Conditional Parameter Estimates

In Table 2, the distribution for each conventional market model parameter estimate is represented by (a) sorting the

TABLE 2

SUMMARY OF DISTRIBUTIONS OF CONVENTIONAL MARKET MODEL PARAMETER ESTIMATES BASED ON 1983 DATA FOR 2,310 NYSE AND ASE FIRMS

		Equal-Weighted Index			*Value-Weighted Index*		
Decile	N	$\hat{\alpha}_c$	$\hat{\beta}_c$	s_c^2	$\hat{\alpha}_c$	$\hat{\beta}_c$	s_c^2
1	253.0	0.0029	2.043	0.00332	0.0036	1.692	0.00334
2	253.0	0.0013	1.587	0.00110	0.0020	1.284	0.00112
3	253.0	0.0008	1.366	0.00080	0.0014	1.102	0.00081
4	253.0	0.0005	1.185	0.00063	0.0010	0.942	0.00064
5	253.0	0.0002	1.029	0.00050	0.0007	0.806	0.00051
6	253.0	−0.0001	0.890	0.00041	0.0005	0.689	0.00041
7	253.0	−0.0005	0.739	0.00033	0.0002	0.552	0.00033
8	253.0	−0.0008	0.580	0.00027	−0.0001	0.418	0.00027
9	252.8	−0.0014	0.413	0.00020	−0.0006	0.290	0.00020
10	192.7	−0.0030	0.162	0.00012	−0.0021	0.090	0.00012
Mean	246.9	−0.0000	0.999	0.00077	0.0007	0.786	0.00077
t-statistic	—	−0.524	87.327	—	18.984	80.302	—

Each column reports the distribution of one parameter estimate. Deciles are formed by ranking all 2,310 observations of each estimate and aggregating into groups of 231 observations each. The average value of the estimate is reported for each decile.

Parameters are estimated using OLS (equation (1)) for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, using all available returns during 1983. *N* represents the number of returns used to estimate the conventional market model parameters for each of the 2,310 firms. Its distribution is presented using the same technique as that used for parameter estimates.

2,310 individual firm estimates in descending order, (b) dividing the sorted list into deciles, and (c) reporting the average estimate for each decile. The same convention is used to summarize news-conditional estimation results in Table 3.

There are clear differences in estimates $\hat{\alpha}$ and $\hat{\beta}$ between the equal-weighted and value-weighted versions of either model. In every decile, the intercept is systematically more positive in the value-weighted case than in the equal-weighted case, while the converse holds true for the slope estimate. This pattern is at least potentially attributable to nonsynchronous return measurement, as explained in Scholes and Williams [1977] and Roll [1981].

Some differences between conventional parameter estimates and news-conditional parameter estimates can be seen by comparing Tables 2 and 3. Compared to conventional estimates, the news-conditional $\hat{\alpha}$ either declines or holds constant in all deciles; the news-conditional $\hat{\beta}$ declines in most deciles; and the news-conditional sample residual variance shows a strict decline in every decile. Finally, in the news-conditional model, the estimated "news coefficient" $\hat{\delta}$ is on average positive and significant, indicating (as was the case in Table 1) that 1983 news releases were associated with positive excess security returns.

Table 4 reports statistics related to the distribution of changes in $\hat{\alpha}$, $\hat{\beta}$, and s^2 across models, including the average change across all 2,310 firms, the sample standard deviation, a *t*-statistic associated with the hypothesis that the mean

TABLE 3

SUMMARY OF DISTRIBUTIONS OF NEWS-CONDITIONAL MARKET MODEL PARAMETER ESTIMATES BASED ON 1983 DATA FOR 2,310 NYSE AND ASE FIRMS

Panel A—Using Equal-Weighted Index

Decile	N	$\hat{\alpha}$	$\hat{\beta}$	$\hat{\delta}$	s^2	$\hat{\Delta}$
1	253.0	0.0027	2.037	0.0219	0.00307	8.760
2	253.0	0.0012	1.574	0.0083	0.00101	3.080
3	253.0	0.0007	1.360	0.0050	0.00073	2.222
4	253.0	0.0005	1.178	0.0028	0.00057	1.818
5	253.0	0.0002	1.025	0.0012	0.00046	1.546
6	253.0	−0.0001	0.887	−0.0002	0.00038	1.325
7	253.0	−0.0005	0.736	−0.0015	0.00031	1.140
8	253.0	−0.0009	0.581	−0.0032	0.00024	0.970
9	252.8	−0.0015	0.408	−0.0061	0.00019	0.782
10	192.7	−0.0031	0.169	−0.0173	0.00011	0.489
Mean	246.9	−0.0001	0.996	0.0011	0.00071	2.212
t-statistic	—	−2.390	87.626	4.647	—	—

Panel B—Using Value-Weighted Index

Decile	N	$\hat{\alpha}$	$\hat{\beta}$	$\hat{\delta}$	s^2	$\hat{\Delta}$
1	253.0	0.0034	1.684	0.0220	0.00309	8.699
2	253.0	0.0018	1.279	0.0082	0.00102	3.056
3	253.0	0.0014	1.095	0.0050	0.00075	2.199
4	253.0	0.0010	0.939	0.0028	0.00058	1.807
5	253.0	0.0007	0.802	0.0013	0.00046	1.534
6	253.0	0.0005	0.685	−0.0002	0.00038	1.322
7	253.0	0.0002	0.551	−0.0015	0.00031	1.137
8	253.0	−0.0002	0.419	−0.0033	0.00024	0.967
9	252.8	−0.0007	0.287	−0.0063	0.00019	0.773
10	192.7	−0.0022	0.095	−0.0174	0.00011	0.478
Mean	246.9	0.0006	0.783	0.0011	0.00071	2.196
t-statistic	—	17.121	80.585	4.504	—	—

Parameters are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, using all available returns during 1983 for the following model:

$$R = XB + u, \tag{2}$$

where

R = a $T \times 1$ vector of security returns;
$X = [1\ M\ D]$;
1 = a $T \times 1$ unit vector;
M = a $T \times 1$ market returns vector;
D = a vector consisting of T_1 zeros and T_2 ones, representing the presence or absence of a news release in the *Wall Street Journal Index*;
$B = [\alpha\ \beta\ \delta]'$;
α = the market model intercept during "no-news" periods;
β = the market model slope parameter;
δ = the return response associated with news releases; and
$u = [z + w]$ is a zero mean disturbance vector.

$$\text{var}(u) = \begin{cases} \sigma_z^2 \text{ during no-news periods} \\ \sigma_z^2 + \sigma_w^2 \text{ during news release periods} \end{cases}$$

$$\Delta = (\sigma_z^2 + \sigma_w^2)/\sigma_z^2$$

Table 4

Change in Estimated Market Model Parameters
Conventional vs. News-Conditional Models
Based on 1983 Data for 2,310 NYSE and ASE Firms

Panel A—Using Equal-Weighted Index

	Mean	*Standard Deviation*	*t-statistic*	N	*N*<0	*N*≥0	Z
$\hat{\alpha}-\hat{\alpha}_c$	−0.00007	0.00091	−3.51	2310	1220	1090	−2.71
$\hat{\beta}-\hat{\beta}_c$	−0.00386	0.07191	−2.58	2310	1194	1116	−1.62
$s^2-s_c^2$	−0.00006	0.00026	−11.19	2310	1703	607	−22.80

Panel B—Using Value-Weighted Index

	Mean	*Standard Deviation*	*t-statistic*	N	*N*<0	*N*≥0	Z
$\hat{\alpha}-\hat{\alpha}_c$	−0.00007	0.00092	−3.39	2310	1224	1086	−2.87
$\hat{\beta}-\hat{\beta}_c$	−0.00295	0.06104	−2.33	2310	1214	1096	−2.46
$s^2-s_c^2$	−0.00006	0.00026	−11.14	2310	1704	606	−22.85

Parameters are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index.* Estimates without subscript represent news-conditional parameter estimates; those with subscript *c* represent conventional (market model) estimates.

change is zero, the number of firms for which the parameter estimate decreased and increased, and a *Z*-statistic associated with the hypothesis that increases and decreases are equally likely. These statistics indicate a statistically significant decline in all three parameters as one moves from conventional estimation to the news-conditional model. These differences, when interpreted using equations (8a) and (8b), indicate that conventional parameter estimates are biased relative to news-conditional estimates when testing a Type B null hypothesis. Whether this bias influences test statistics can be addressed directly by comparing conventional and news-conditional standardized prediction errors.

Conventional and News-Conditional Standardized Prediction Errors

Patell [1976] introduced several market model-based statistics that can be used to test Type A null hypotheses. All of these are based either on standardized prediction errors ($V_{c\tau}$) or on squared standardized prediction errors ($U_{c\tau}$). $V_{c\tau}$, as defined by Patell, is given by equation (7c) and follows a *t*-distribution with $T-2$ degrees of freedom. The squared standardized prediction error is:

$$U_{c\tau}=V_{c\tau}^2(T-2)/(T-4) \qquad (12)$$

and is *F*-distributed with 1 and $T-2$ degrees of freedom. The news-conditional analog of $V_{c\tau}$ is denoted V_τ and is defined in equation (4c). The news-conditional analog of $U_{c\tau}$ is U_τ and is defined as:

$$U_\tau=V_\tau^2(T-3)/(T-5). \qquad (13)$$

Tables 5 and 6 are tabulations of the effects of estimation period news on *V*- and *U*-statistics associated with the 33,994 sample firm news events which occurred during 1983. These tables were constructed as follows. News-conditional statistics (V_τ and U_τ) and conventional statistics ($V_{c\tau}$ and $U_{c\tau}$) were cal-

TABLE 5

DISTRIBUTION OF STANDARDIZED PREDICTION ERRORS BASED ON 33,994 NEWS EVENTS FOR 2,310 NYSE AND ASE FIRMS DURING 1983

$(V-V_c)/|V_c|$

Panel A—Using Equal-Weighted Market Returns

	Range of Conventional Standardized Prediction Error (V_c)																
Percent	*< −5.0*	*−5.0*	*−4.0*	*−3.0*	*−2.0*	*−1.5*	*−1.0*	*−0.5*	*0*	*0.5*	*1.0*	*1.5*	*2.0*	*3.0*	*4.0*	*5.0*	*>5.0*
< −100	0.0	0.9	0.4	0.1	0.2	0.2	0.3	6.5		5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−100	0.0	0.0	0.0	0.2	0.0	0.1	0.2	0.8		0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−90	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.8		0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−80	0.0	0.0	0.0	0.0	0.2	0.4	0.3	1.2		1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−70	1.4	0.0	0.0	0.0	0.8	0.3	0.4	1.5		1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−60	4.2	0.0	0.4	0.8	0.5	0.3	0.6	2.0		1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
−50	1.4	1.9	0.0	0.5	0.8	0.7	1.2	2.3		1.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0
−40	1.4	2.8	1.5	1.4	1.1	2.0	1.7	4.4		3.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0
−30	4.2	3.8	4.1	2.2	3.6	2.8	4.8	6.8		4.9	1.6	1.2	0.6	0.2	0.0	0.6	0.0
−20	11.3	10.4	13.3	10.5	10.0	12.5	14.3	11.2		8.6	4.5	2.5	2.4	1.0	0.5	0.0	0.0
−10	59.2	60.4	57.2	57.8	54.4	50.4	40.6	19.0		17.0	29.9	29.6	28.0	23.6	21.6	25.3	17.2
0																	
10	15.5	19.8	22.5	25.6	26.7	27.5	30.0	16.5		17.5	39.1	47.2	52.3	57.6	61.0	56.3	61.5
20	1.4	0.0	0.7	0.9	1.8	2.1	4.0	8.8		11.2	13.4	11.5	11.2	13.0	11.4	14.6	11.5
30	0.0	0.0	0.0	0.0	0.0	0.6	0.8	4.4		6.3	5.5	4.1	2.5	2.3	2.3	1.9	2.9
40	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.5		3.7	1.6	1.3	1.1	0.9	1.4	0.6	2.9
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0		2.8	0.7	0.3	0.5	1.0	1.2	0.0	1.1
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4		1.9	0.3	0.6	0.9	0.1	0.5	0.6	0.6
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0		1.7	0.3	0.4	0.2	0.1	0.2	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0		0.9	0.3	0.4	0.1	0.0	0.0	0.0	1.7
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6		1.0	0.4	0.1	0.1	0.2	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5		0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.6
>100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7		6.7	0.6	0.3	0.2	0.1	0.0	0.0	0.0
N	71	106	271	930	1324	2811	4960	6946		6389	4286	2473	1420	1244	431	158	174
Mean	−9.0	−7.4	−5.5	−5.0	−5.3	−5.4	−5.9	−22.9		36.2	5.4	4.9	4.6	5.0	5.2	4.6	7.8

TABLE 5—*Continued*

Panel B—Using Value-Weighted Market Returns

Percent	*<−5.0*	*−5.0*	*−4.0*	*−3.0*	*−2.0*	*−1.5*	*−1.0*	*−0.5*	*0*	*0.5*	*1.0*	*1.5*	*2.0*	*3.0*	*4.0*	*5.0*	*>5.0*
	Range of Conventional Standardized Prediction Error (V_c)																
<−100	0.0	1.0	0.4	0.3	0.2	0.4	1.0	6.6		6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−100	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.0		0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−90	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.7		0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−80	0.0	0.0	0.0	0.0	0.7	0.0	0.3	1.3		0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−70	2.9	0.0	0.0	0.3	0.2	0.1	0.4	1.6		1.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
−60	2.9	0.0	0.4	0.7	0.5	0.3	0.8	1.9		1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0
−50	1.4	1.9	0.0	0.3	0.9	1.1	1.4	2.3		1.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0
−40	1.4	3.8	1.5	1.5	1.6	1.9	2.5	4.3		2.8	0.6	0.6	0.3	0.0	0.0	0.0	0.0
−30	4.3	2.9	3.4	2.8	3.8	3.6	4.7	6.2		4.5	1.1	1.2	1.1	0.6	0.5	0.0	0.0
−20	10.0	12.5	14.2	9.8	10.2	11.7	14.2	11.4		8.7	4.4	2.1	1.4	0.9	0.2	0.0	0.0
−10	58.6	61.5	56.2	60.2	53.7	51.0	40.0	18.2		16.8	30.2	29.2	26.5	23.3	20.9	24.2	16.2
0																	
10	18.6	16.3	23.6	23.7	27.4	28.0	30.3	17.6		17.7	38.8	47.8	53.9	56.7	62.5	56.7	63.6
20	0.0	0.0	0.4	0.2	0.7	0.9	3.8	8.5		10.7	12.0	11.6	11.7	14.8	10.7	12.7	12.7
30	0.0	0.0	0.0	0.0	0.0	0.2	0.6	4.7		6.2	6.2	4.4	2.7	1.5	3.4	4.5	1.2
40	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.4		3.8	2.2	0.9	0.8	1.3	0.2	0.0	2.9
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8		2.7	0.9	0.6	0.6	0.6	1.1	0.0	0.6
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3		2.0	0.4	0.5	0.4	0.1	0.2	1.9	0.6
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9		1.3	0.5	0.4	0.2	0.1	0.2	0.0	0.6
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6		1.2	0.3	0.2	0.1	0.0	0.0	0.0	1.2
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7		1.0	0.4	0.2	0.0	0.2	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6		0.8	0.3	0.1	0.1	0.1	0.0	0.0	0.6
>100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2		7.1	0.5	0.2	0.2	0.1	0.0	0.0	0.0
N	70	104	267	948	1288	2818	5052	6980		6397	4211	2430	1421	1238	440	157	173
Mean	−9.0	−8.0	−5.6	−5.4	−5.8	−6.2	−6.8	−38.7		−24.8	5.4	4.9	4.4	4.9	5.0	5.5	7.5

Standardized prediction errors are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, based on the conventional and news-conditional market models. Within each panel, each column reports the number of news events for the indicated conventional standardized prediction error (*N*), the percentage of these events whose standardized prediction error changes by the indicated amount, and the mean percentage change in standardized prediction errors for the indicated conventional range (mean). Thus, for the 1,420 conventional standardized prediction errors calculated using the equal-weighted index with values between 1.5 and 2.0, 11.2 percent recorded news-conditional standardized prediction errors that increased between 10 and 20 percent.

TABLE 6

DISTRIBUTION OF SQUARED STANDARDIZED PREDICTION ERRORS BASED ON 33,994 NEWS EVENTS FOR 2,310 NYSE AND ASE FIRMS DURING 1983

$(U-U_c)/|U_c|$

Panel A—Using Equal-Weighted Market Returns

	Range of Conventional Squared Standardized Prediction Error (U_c)							
Percent	*0.00-0.25*	*0.25-1.00*	*1.00-2.25*	*2.25-4.00*	*4.00-9.00*	*9.00-16.00*	*16.00-25.00*	*>25.00*
<−100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−100	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−90	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−80	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0
−70	2.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
−60	2.5	0.5	0.2	0.0	0.0	0.0	0.0	0.0
−50	3.0	0.8	0.3	0.3	0.1	0.1	0.0	0.0
−40	4.3	1.0	1.0	0.9	0.3	0.1	0.0	0.0
−30	5.4	3.1	1.7	1.2	0.6	0.3	0.0	0.4
−20	8.1	8.6	4.1	3.1	1.9	1.7	0.4	0.4
−10	9.4	21.8	24.6	24.1	22.7	20.0	23.0	16.5
0								
10	10.0	25.2	32.0	36.4	40.1	41.6	38.1	40.1
20	7.7	13.7	15.7	16.1	16.5	17.7	17.1	20.2
30	6.0	8.1	7.7	7.4	7.1	8.2	10.1	8.3
40	4.3	5.5	4.2	3.6	4.5	4.2	4.3	3.3
50	3.8	3.3	2.7	1.7	2.3	1.9	0.8	1.2
60	2.7	2.1	1.3	1.1	0.6	0.9	1.6	1.7
70	2.1	1.2	0.7	1.0	0.7	0.7	1.2	0.8
80	1.7	0.8	0.9	0.6	0.5	0.4	0.8	1.2
90	1.5	0.5	0.6	0.3	0.4	0.4	0.4	1.2
100	1.2	0.5	0.2	0.2	0.4	0.4	0.4	0.0
>100	17.1	3.2	2.1	2.0	1.4	1.3	1.9	4.5
N	13380	9250	5277	2735	2158	695	257	242
Mean	(a)	14.6	12.6	11.7	11.5	11.8	14.3	18.6

culated for each event. Cumulative two-day standardized prediction errors were formed as a normalized sum of the V-statistic for the *Wall Street Journal* publication date and that of the preceding trading day. Parameters were re-estimated for each news event using all available 1983 daily returns for the firm in question other than those in the two-day event window. For each news event, percentage changes were then calculated for V and U as: $(V-V_c)/|V_c|$ and $(U-U_c)/|U_c|$. These percentage changes are presented in Tables 5 and 6. For example, panel A of Table 5 indicates that 6,389 events had V_c values in the range $0.0-0.5$. The news-conditional standardized prediction error was between zero and ten percent higher than the conventional standardized prediction error for 17.5 percent (or 1,118) of these observations. The average percentage change for all 6,389 events was 36.2, with 54.5 percent (or 3,482) having positive changes.

Table 5 indicates that, relative to news-conditional V-statistics, conventional V-statistics are systematically

TABLE 6—*Continued*

Panel B—Using Value-Weighted Market Returns

	Range of Conventional Squared Standardized Prediction Error (U_c)							
Percent	*0.00–0.25*	*0.25–1.00*	*1.00–2.25*	*2.25–4.00*	*4.00–9.00*	*9.00–16.00*	*16.00–25.00*	*>25.00*
<−100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−100	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−90	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
−80	1.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
−70	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
−60	2.4	0.3	0.3	0.3	0.0	0.0	0.0	0.0
−50	3.0	0.6	0.4	0.5	0.2	0.1	0.0	0.0
−40	4.0	0.8	0.5	0.3	0.2	0.3	0.0	0.0
−30	5.6	3.0	1.1	0.6	0.5	0.1	0.0	0.0
−20	8.3	7.9	4.0	2.9	1.5	1.3	0.8	0.8
−10	9.8	22.8	24.7	24.2	22.1	19.9	21.0	15.8
0								
10	9.5	24.4	32.9	37.0	41.7	41.5	38.9	40.4
20	7.9	14.2	15.5	15.6	15.5	17.5	16.3	21.2
30	5.9	8.1	7.6	7.8	7.8	8.8	11.9	8.7
40	4.4	5.0	3.8	3.7	4.4	4.4	2.8	2.1
50	3.4	2.8	2.9	1.9	2.1	2.0	0.8	2.1
60	2.6	2.2	1.5	1.2	0.7	1.6	2.8	0.8
70	2.0	1.7	1.0	0.9	0.6	0.6	0.8	0.8
80	1.8	1.1	0.5	0.8	0.6	0.1	0.8	1.2
90	1.5	0.7	0.6	0.3	0.3	0.6	0.4	1.2
100	1.1	0.5	0.5	0.3	0.5	0.3	0.4	0.0
>100	17.6	3.5	2.2	1.9	1.2	1.0	2.4	4.6
N	13419	9270	5235	2700	2170	708	252	240
Mean	(a)	16.1	13.6	12.1	11.7	11.8	15.4	18.7

(a) indicates that the percentage change is not reported because the denominator approaches zero for some events. Squared standardized prediction errors are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, based on the conventional and news-conditional market models. Within each panel, each column reports the number of news events for the indicated conventional squared standardized prediction error (*N*), the percentage of these events whose squared standardized prediction error changes by the indicated amount, and the mean percentage change in squared standardized prediction errors for the indicated conventional range (mean). Thus, for the 2,735 conventional squared standardized prediction errors calculated using the equal-weighted index with values between 2.25 and 4.0, 16.1 percent recorded news-conditional squared standardized prediction errors that increased between 10 and 20 percent.

biased toward zero. That is, the average percentage change is consistently negative across the left tail of the V_c distribution, and consistently positive (except for one instance in the value-weighted case) across the right tail. For *V*-statistics whose absolute value exceeds one, the change ranges from 4.4 to 9.0 percent.

Table 6 shows percentage changes in *U*. Again, relative to news-conditional *U*-statistics, the conventional *U*-statistics are systematically biased toward zero. The magnitude of the average bias ranges from 11.5 to 18.7 percent for *U*-statistics greater than one.

V. ALTERNATIVE ESTIMATION PROCEDURES

The news-conditional model is costly to implement for two reasons: (1) news

TABLE 7

CHANGE IN ESTIMATED MARKET MODEL PARAMETERS
CONVENTIONAL VS. FOUR ALTERNATIVE MODELS
BASED ON 1983 DATA FOR NYSE AND ASE FIRMS

Panel A—Using Equal-Weighted Index

	All-News Conditional (N=2310)		*E/D-News Conditional (N=2275)*		*OLS—All News Omitted (N=2310)*		*OLS—E/D News Omitted (N=2275)*	
	Mean	*t-statistic*	*Mean*	*t-statistic*	*Mean*	*t-statistic*	*Mean*	*t-statistic*
$\hat{\alpha}-\hat{\alpha}_c$	−0.00007	−3.51	−0.00005	−4.41	−0.00007	−3.56	−0.00005	−4.92
$\hat{\beta}-\hat{\beta}_c$	−0.00386	−2.58	−0.00502	−3.31	−0.00239	−0.92	−0.00317	−2.01
$s^2-s_c^2$	−0.00006	−11.19	−0.00002	−8.43	−0.00006	−11.28	−0.00003	−8.80

Panel B—Using Value-Weighted Index

	All-News Conditional (N=2310)		*E/D-News Conditional (N=2275)*		*OLS—All News Omitted (N=2310)*		*OLS—E/D News Omitted (N=2275)*	
	Mean	*t-statistic*	*Mean*	*t-statistic*	*Mean*	*t-statistic*	*Mean*	*t-statistic*
$\hat{\alpha}-\hat{\alpha}_c$	−0.00007	−3.39	−0.00005	−4.69	−0.00006	−3.31	−0.00005	−4.90
$\hat{\beta}-\hat{\beta}_c$	−0.00295	−2.33	−0.00403	−2.42	−0.00402	−1.93	−0.00346	−2.58
$s^2-s_c^2$	−0.00006	−11.14	−0.00002	−8.03	−0.00006	−11.23	−0.00003	−8.71

Parameters are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index.* The subscript *c* denotes conventional (market model) parameter estimates. Estimates without subscript derive from four alternative procedures:

a. *All-News Conditional* estimates are those from the news-conditional model reported in Table 4.
b. *E/D-News Conditional* estimates are those from a news-conditional model in which "news dates" are defined as earnings and dividend release dates only.
c. *OLS—All News Omitted* estimates are those from an OLS market model regression that excludes all *Wall Street Journal* news dates from the estimation data set.
d. *OLS—E/D News Omitted* estimates are those from an OLS market model regression that excludes *Wall Street Journal* earnings and dividend release dates from the estimation data set.

release dates must be acquired for all relevant news items, and (2) GLS estimation, rather than OLS estimation, is used. This section considers other techniques that recognize the influence of news on estimation period returns, but which are less costly to implement along one or both of these dimensions. Four models are discussed:

a. *All-News Conditional Model*: This model is the news-conditional model described in Section II and estimated as described in Section IV. It is conditioned on all *Wall Street Journal Index* news release dates and is estimated using GLS.
b. *E/D-News Conditional Model*: This model is the news-conditional model described in Section II. It is conditioned on earnings and dividend dates only and is estimated using GLS. Its use is motivated by the availability of these dates in the CRSP and COMPUSTAT files.
c. *OLS—All News Omitted Model*: This model is a market model as described in Section I. It is esti-

mated using OLS procedures over "no-news" returns only. A return is termed "no-news" if the return date is neither the day of nor the trading day preceding a *Wall Street Journal Index* news date.

d. *OLS—E/D News Omitted Model*: This model is comparable to the preceding model, except that news is defined as earnings and dividend releases only.

Table 7 presents a comparison of parameter estimates for models a–d. All four model variations have lower estimated intercept, slope, and residual variance than does the conventional market model. Models that consider all *Wall Street Journal Index* news (a and c) exhibit substantially greater declines in residual variance relative to the conventional model than those that consider earnings and dividend releases only. This suggests that standardized and squared standardized prediction errors will be larger (in absolute terms) for these two models, relative to conventional values.

Tables 8 and 9 confirm this speculation. In Table 8, standardized prediction errors for all four model variations are more widely dispersed than those of the conventional model. Those for the "all-news" models (both GLS and OLS) are substantially more dispersed than those for the "earnings- and dividends-only" models. Table 9 shows the same pattern for squared standardized prediction errors. These tables also indicate that the gains achieved using GLS, for a given definition of news, are positive but small relative to those provided by OLS estimation excluding news dates. Taken together, these comparisons suggest that the improvement of the news-conditional model relative to the conventional market model is primarily due to the use of all *Wall Street Journal Index* news dates in model estimation.

VI. CONCLUDING REMARKS

Based on evidence presented above, the distribution of security returns during periods in which *Wall Street Journal* news is released appears to differ systematically from the distribution of non-release period returns. This "news-release" effect can be incorporated in models of the returns generating process by conditioning on news releases. We demonstrate that conventional market model parameter estimates are biased relative to those derived from the news-conditional market model developed in Section II. Under a Type B null hypothesis (i.e., category-η news versus no firm-specific news releases), conventional market model test statistics are also potentially biased.

Security prices for 2,310 NYSE and ASE firms and news items listed in the 1983 *Wall Street Journal Index* were used to estimate both conventional and news-conditional market model parameters. Test statistics based on the news-conditional market model differ from those based on the conventional market model in the following ways:

a. Relative to news-conditional statistics, conventional standardized prediction errors (V) and squared standardized prediction errors (U), are biased systematically toward zero.

b. The magnitude of the bias is not large in absolute terms—for the average firm, it amounts to roughly five to nine percent for standardized prediction errors, and 11 to 18 percent for squared standardized prediction errors.

Based on these results, event study test statistics derived from a news-conditional market model under a Type B null hypothesis, are more likely to reject the null hypothesis than those derived from

TABLE 8

DISTRIBUTION OF STANDARDIZED PREDICTION ERRORS FOR ALTERNATIVE ESTIMATION MODELS $(V-V_c)/|V_c|$

Panel A—Using Equal-Weighted Market Returns

	Range of Conventional Standardized Prediction Error (V_c)																
	<−5.0	*−5.0*	*−4.0*	*−3.0*	*−2.0*	*−1.5*	*−1.0*	*−0.5*	*0.0*	*0.5*	*1.0*	*1.5*	*2.0*	*3.0*	*4.0*	*5.0*	*>5.0*
All-News Conditional																	
N	71	106	271	930	1324	2811	4960	6946		6389	4286	2473	1420	1244	431	158	174
Mean	−9.0	−7.4	−5.5	−5.0	−5.3	−5.4	−5.9	−22.9		36.2	5.4	4.9	4.6	5.0	5.2	4.6	7.8
E/D-News Conditional																	
N	71	105	268	920	1315	2796	4930	6892		6333	4258	2453	1412	1231	427	156	171
Mean	−2.6	−3.0	−2.3	−1.8	−1.4	−1.5	−1.2	6.1		−9.6	2.3	2.0	2.0	2.3	2.0	2.6	1.9
OLS—All News Omitted																	
N	71	106	271	930	1324	2811	4960	6946		6389	4286	2473	1420	1244	431	158	174
Mean	−8.7	−7.2	−5.1	−4.6	−5.0	−4.9	−5.3	14.1		49.9	5.3	4.7	4.5	4.7	4.8	4.4	7.6
OLS—E/D News Omitted																	
N	71	105	268	920	1315	2796	4930	6892		6333	4258	2453	1412	1231	427	156	171
Mean	−2.4	−2.7	−2.0	−1.6	−1.4	−1.3	−1.1	30.2		−7.3	2.2	1.7	1.7	2.1	1.9	2.4	1.9

Panel B—Using Value-Weighted Market Returns

	Range of Conventional Standardized Prediction Error (V_c)																
	<−5.0	*−5.0*	*−4.0*	*−3.0*	*−2.0*	*−1.5*	*−1.0*	*−0.5*	*0.0*	*0.5*	*1.0*	*1.5*	*2.0*	*3.0*	*4.0*	*5.0*	*>5.0*
All-News Conditional																	
N	70	104	267	948	1288	2818	5052	6980		6397	4211	2430	1421	1238	440	157	173
Mean	−9.0	−8.0	−5.6	−5.4	−5.8	−6.2	−6.8	−38.7		−24.8	5.4	4.9	4.4	4.9	5.0	5.5	7.5
E/D-News Conditional																	
N	70	103	264	938	1280	2802	5024	6922		6342	4179	2415	1414	1225	435	155	170
Mean	−2.5	−3.2	−2.1	−1.9	−1.5	−1.5	−1.2	10.9		−32.1	2.2	2.0	1.8	2.3	2.1	2.4	1.9
OLS—All News Omitted																	
N	70	104	267	948	1288	2818	5052	6980		6397	4211	2430	1421	1238	440	157	173
Mean	−8.7	−7.9	−5.4	−5.1	−5.5	−5.8	−6.4	−37.6		−58.5	5.4	4.6	4.1	4.5	4.6	5.3	7.3
OLS—E/D News Omitted																	
N	70	103	264	938	1280	2802	5024	6922		6342	4179	2415	1414	1225	435	155	170
Mean	−2.3	−2.9	−1.9	−1.7	−1.4	−1.3	−1.1	9.0		−44.4	2.0	1.9	1.6	2.1	1.9	2.2	1.9

Standardized prediction errors are estimated for each firm listed on the NYSE or ASE during 1983 with news items recorded in the *Wall Street Journal Index*, based on the conventional and alternative estimation models. For each alternative model, the table reports the number of news events within the specified range of conventional standardized prediction errors (N), and the mean percentage change when the alternative model is used (mean).

Table 9
Distribution of Squared Standardized Prediction Errors for Alternative Estimation Models
$(U-U_c)/|U_c|$

Panel A—Using Equal-Weighted Market Returns

	Range of Conventional Squared Standardized Prediction Error (U_c)							
	0.00–0.25	*0.25–1.00*	*1.00–2.25*	*2.25–4.00*	*4.00–9.00*	*9.00–16.00*	*16.00–25.00*	*>25.00*
All-News Conditional								
N	13380	9250	5277	2735	2158	695	257	242
Mean	(a)	14.6	12.6	11.7	11.5	11.8	14.3	18.6
E/D-News Conditional								
N	13268	9193	5243	2718	2135	688	254	239
Mean	(a)	3.8	3.7	3.6	4.5	4.5	6.4	4.3
OLS—All News Omitted								
N	13380	9250	5277	2735	2158	695	257	242
Mean	(a)	14.4	11.6	10.9	10.2	10.7	13.6	17.9
OLS—E/D News Omitted								
N	13268	9193	5243	2718	2135	688	254	239
Mean	(a)	3.5	3.3	3.2	4.1	4.1	5.9	4.2

Panel B—Using Value-Weighted Market Returns

	Range of Conventional Squared Standardized Prediction Error (U_c)							
	0.00–0.25	*0.25–1.00*	*1.00–2.25*	*2.25–4.00*	*4.00–9.00*	*9.00–16.00*	*16.00–25.00*	*>25.00*
All-News Conditional								
N	13419	9270	5235	2700	2170	708	252	240
Mean	(a)	16.1	13.6	12.1	11.7	11.8	15.4	18.7
E/D-News Conditional								
N	13306	9210	5203	2686	2147	700	249	237
Mean	(a)	3.7	3.8	3.4	4.6	4.4	6.2	4.3
OLS—All News Omitted								
N	13419	9270	5235	2700	2170	708	252	240
Mean	(a)	15.6	12.3	10.8	10.4	10.6	14.8	18.0
OLS—E/D News Omitted								
N	13306	9210	5203	2686	2147	700	249	237
Mean	(a)	3.4	3.4	3.1	4.1	4.0	5.7	4.2

(a) indicates that the percentage change is not reported because the denominator approaches zero for some events. Squared standardized prediction errors are estimated for each firm listed on the NYSE or ASE during 1983 with news items in the *Wall Street Journal Index*, based on the conventional and alternative estimation models. For each alternative model, the table reports the number of news events within the specified range of conventional squared standardized prediction errors (N), and the mean percentage change when the alternative model is used (mean).

the conventional market model. This increase in power appears to be due primarily to the inclusion of a broad set of firm-specific news events (i.e., those reported in the *Wall Street Journal Index*) in the model specification.

APPENDIX

This appendix briefly sketches the derivation of the probability limits asserted in equations (5) and (10).

Equations (5)

Equations (5a) and (5b) are standard econometric results (see Theil [1971, p. 398]). In the case of equation (5c), by Slutsky's theorem,

$$\text{plim}\ V_\tau = \frac{r_\tau - x_\tau(\text{plim}\ \hat{B})}{(\text{plim}\ s)[1 + x_\tau(\text{plim}\ (X'\Omega^{-1}X)^{-1}x_\tau')]^{1/2}} \tag{A.1}$$

Plim $(X'\Omega^{-1}X)^{-1} = T^{-1}(\text{plim}\ T^{-1}X'\Omega^{-1}X)^{-1}$ converges to zero because the factor in parentheses converges to a matrix of finite moments. Thus,

$$\text{plim}\ V_\tau = \frac{r_\tau - x_\tau(\text{plim}\ \hat{B})}{\text{plim}\ s} \tag{A.2}$$

and substitution of equations (5a) and (5b) in equation (A.2) yields equation (5c).

Equations (8)

To derive equation (8a), recall that:

$$\begin{aligned} \hat{B}_c &= (X_c'X_c)^{-1}X_c'R \\ &= (X_c'X_c)^{-1}X_cXB + (X_c'X_c)^{-1}X_c'u \\ &= (X_c'X_c)^{-1}X_c'[X_c\ D][B_c'\ \delta]' + (T^{-1}X_c'X_c)^{-1}(T^{-1}X_c'u) \end{aligned} \tag{A.3}$$

Since plim $(T^{-1}X_c'u) = 0$,

$$\begin{aligned} \text{plim}\ \hat{B}_c &= \text{plim}\ (X_c'X_c)^{-1}X_c'[X_c\ D][B_c'\ \delta]' \\ &= \text{plim}\ [I_2\ (X_c'X_c)^{-1}X_c'D][B_c'\ \delta]' \\ &= \text{plim}\ [B_c + \delta(X_c'X_c)^{-1}X_c'D] \\ &= \text{plim}\ [B_c + \delta\Gamma] \\ &= [\alpha + \delta\gamma_1 \beta + \delta\gamma_2] \end{aligned} \tag{A.4}$$

where $\Gamma = [\gamma_1\ \ \gamma_2]$ is the vector of coefficients for a regression of D on X_c. Substituting $\gamma_1 = \mu_D - \gamma_2\mu_M$ in equation (A.4) yields equation (8a).

To derive equation (8b), first note that the conventional residual vector can be written as:

$$\begin{aligned} e &= R - X_c\hat{B}_c \\ &= XB + u - X_c(X_c'X_c)^{-1}X_c'(XB + u) \\ &= [I_T - X_c(X_c'X_c)^{-1}X_c'][XB + u] \\ &= H[XB + u] \\ &= H[X_c\ D][B_c'\ \delta]' + Hu \\ &= H[\delta D + u]. \end{aligned} \tag{A.5}$$

The matrix H is idempotent. Therefore, the residual variance s_c^2 can be expressed as:

$$\begin{aligned} s_c^2 &= (T-2)^{-1}e'e \\ &= (T-2)^{-1}[u + \delta D]'H[u + \delta D] \\ &= (T-2)^{-1}\{u'u + u'\delta D - u'X_c(X_c'X_c)^{-1}X_c'u \\ &\qquad - u'X_c(X_c'X_c)^{-1}X_c'\delta D + \delta D'u + \delta^2 D'D \\ &\qquad - \delta D'X_c(X_c'X_c)^{-1}X_c'u - \delta^2 D'X_c(X_c'X_c)^{-1}X_c'D\} \end{aligned} \tag{A.6}$$

On a term by term basis, the probability limits associated with the second, third, fourth, fifth, and seventh terms of equation (A.6) are zero, since each of these includes a factor of the form $(T-2)^{-1}u'D$ or $(T-2)^{-1}u'X_c$. In the limit, the former is a scalar zero, while the latter is a one by two zero vector. Eliminating these terms gives:

$$\text{plim } s_c^2=\text{plim }\{(T-2)^{-1}u'u+(T-2)^{-1}\delta^2D'D-(T-2)^{-1}\delta^2D'X_c(X_c'X_c)^{-1}X_c'D\}. \tag{A.7}$$

With respect to the first term of equation (A.7), note that:

$$\begin{aligned}(T-2)^{-1}u'u&=(T-2)^{-1}[u_{nn}'\ u_n'][u_{nn}\ u_n]'\\&=(T-2)^{-1}[u_{nn}'u_{nn}+u_n'u_n]\\&=\frac{T_1}{T-2}\bullet\frac{1}{T_1}\bullet u_{nn}'u_{nn}+\frac{T_2}{T-2}\bullet\frac{1}{T_2}\bullet u_n'u_n,\end{aligned} \tag{A.8}$$

where u_{nn} and u_n represent the "without news" and "with news" components of the disturbance vector u. Thus,

$$\begin{aligned}\text{plim }(T-2)^{-1}u'u&=\text{plim }\frac{T_1}{T-2}\bullet\text{plim }\frac{1}{T_1}\bullet u_{nn}'u_{nn}+\text{plim }\frac{T_2}{T-2}\bullet\text{plim }\frac{1}{T_2}\bullet u_n'u_n\\&=(1-\mu_D)\sigma_z^2+\mu_D\Delta\sigma_z^2\end{aligned} \tag{A.9}$$

For the second term of equation (A.7), since $D'D=T_2$,

$$\text{plim }(T-2)^{-1}\delta^2D'D=\delta^2\text{plim }(T_2/(T-2))=\delta^2\mu_D \tag{A.10}$$

The third term of equation (A.7) can be written as:

$$\begin{aligned}A&=(T-2)^{-1}\delta^2D'X_c(X_c'X_c)^{-1}X_c'D\\&=(T-2)^{-1}\delta^2[\Gamma'X_c'+\phi']X_c\hat{\Gamma}\\&=(T-2)^{-1}\delta^2[\Gamma'X_c'X_c\Gamma]+(T-2)^{-1}\delta^2\phi'X_c\hat{\Gamma},\end{aligned} \tag{A.11}$$

with Γ as defined in equation (A.4), and ϕ a mean zero disturbance vector independent of X_c. Therefore,

$$\begin{aligned}\text{plim } A&=\delta^2\Gamma'(\text{plim }(T-2)^{-1}X_c'X_c)\Gamma\\&=\delta^2(\gamma_1^2+2\gamma_1\gamma_2\mu_M+\gamma_2^2\mu_{M^2})\end{aligned} \tag{A.12}$$

where μ_{M^2} is the expected value of r_m^2 (or equivalently the second moment of r_m). Substituting $\gamma_1=\mu_D-\gamma_2\mu_M$,

$$\begin{aligned}\text{plim } A&=\delta^2\{\mu_D^2+\gamma_2^2(\mu_{M^2}-\mu_M^2)\}\\&=\delta^2\{\mu_D^2+\gamma_2^2\sigma_M^2\}\end{aligned} \tag{A.13}$$

Combining equations (A.9), (A.10), and (A.13) yields equation (8b).

Finally, equation (8c) can be derived, using Slutsky's theorem, by substituting equations (8a) and (8b) in equation (7c), and by noting that $(X_c'X_c)^{-1}=T^{-1}[(1/T)X_c'X_c]^{-1}$ converges to a zero matrix as T grows large.

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Organizational Coordination and Performance in Hospital Accounting Information Systems: An Empirical Investigation

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ABSTRACT: This paper describes a field study of 28 hospital accounting information systems (HAIS) development groups designed to address the issue of "fit" between organizational context and the effective design of management accounting systems (MAS). Hypotheses are developed for studying the interaction effects of contextual and MAS design variables on performance. The findings indicate that the match between HAIS task predictability and coordination modes is significantly associated with good performance as measured by user information satisfaction.

The issue of "fit" between organizational context and the effective design of management accounting systems (MAS) has been of interest to many scholars [Bruns and Waterhouse, 1975; Chenhall and Morris, 1986; Gordon and Miller, 1976; Merchant, 1981; Otley, 1980; and Waterhouse and Tiessen, 1978], but the results to date have been difficult to integrate and often conflicting.

Since there is an increasing emphasis in research on contingency theory and organizational performance [Daft and MacIntosh, 1981; Fry, 1982; and Otley, 1980], several studies have included performance in their research design [Argote, 1982; Chenhall and Morris, 1986; Fry and Slocum, 1984; Hayes, 1977; and Schoonhoven, 1981]. However, the weakness common to the studies using organizational performance as a dependent variable is a lack of control over confounding variables that may have affected performance. Confounding variables may not be included in research designs because of the difficulties in identifying and measuring those variables. However, without neutralizing the effects of as many of the rival hypotheses as possible, it is hard to determine how changes in the MAS design

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variables cause variations in performance.

Another problem with the existing literature involves the various levels of analysis used [Alexander and Randolph, 1985; Fry, 1982; Fry and Slocum, 1984; and Merchant, 1981]. Studies of organizational context and structure have been conducted at the organization, subunit, and individual levels, with no attempt to control for the possible effects of variation in levels [Fry, 1982]. Matching the level of analysis in these studies is critical for identifying appropriate contingent factors for the MAS design variable [Pfeffer, 1982]. For example, Merchant [1981] criticized previous studies on budgeting behavior for lower levels of analysis (individual level), when he studied budgeting in the corporate context. This limitation has led to conflicting results and an inability to interpret results across studies. This paper reports the findings of an empirical study directed at examining these specific shortcomings.

This study has three primary purposes. First, it attempts to extend existing work on contingency theory by examining whether the match between technology and coordination modes of hospital accounting information systems (HAIS) development groups leads to higher performance, when the effects of confounding variables are controlled. Second, the study examines the contingency relation at the work group level (i.e., HAIS development group), at which decisions regarding changes in technology are made [Fry and Slocum, 1984; Pfeffer, 1982; and Van de Ven, Delbecq, and Koenig, 1976]. Third, it considers multiple contingencies, three technology dimensions and work group size, to investigate which of the various elements of contextual factors is important for the effective design of HAIS group coordination modes.

INDEPENDENT VARIABLES

Technology

Organizational contextual variables, thought to be critical for the functioning of organizations, include environmental uncertainty [Lawrence and Lorsch, 1969; Duncan, 1972], organizational size [Child, 1975; Galbraith, 1973], and technology [Perrow, 1967; Thompson, 1967; and Woodward, 1965].

In small departments, technology has been found to have a significant effect on organizational structure because personnel in small departments are located close to the technical activities of that unit [Hrebiniak, 1974; Van de Ven et al., 1976; and Kmetz, 1977/1978]. Pfeffer [1982] provides the theoretical underpinnings of the technology-structure relation:

> . . . technology . . . affects the skills and discretion of the work force and, thus, the control that must be employed; different structural arrangements . . . imply different types of control structures and procedures; and, therefore, technology is linked to structure through its requirements for procedures to control work. . . . [pp. 152–154]

Various authors have posited a variety of technology typologies, but three dimensions are basic to all, and they depict what is meant by "the technology construct" [Fry and Slocum, 1984]. These dimensions are task predictability, problem analyzability, and task interdependence.

Task predictability, also called "task variety," denotes the number of exceptions in the work, or the frequency of unexpected and novel events that occur in the conversion process [Perrow, 1970]. *Problem analyzability* denotes the degree to which one can analyze the unexpected events [Perrow, 1970]. Objective or computational procedures usually are followed to resolve analyzable exceptions. For unanalyzable exceptions, individuals may have to spend time thinking about what to do, relying on accumulated experience, intuition, and judgment. *Task interdependence* denotes the extent to which unit personnel depend upon one another to perform their individual jobs [Thompson, 1967]. Task interdependence can be further categorized as pooled, sequential, reciprocal, or team.

Coordination Modes

Coordination involves integrating the various organizational activities to achieve organizational objectives. Coordination is needed due to the interdependent nature of the activities that organization members perform. Coordination can be achieved through a variety of means (e.g., administrative vs. interpersonal), and several typologies of coordination methods have been advanced [Bruns and Waterhouse, 1975; Merchant, 1981; Thompson, 1967; and Van de Ven et al., 1976]. The one that is used in this study is the categorization of coordination modes into either impersonal or personal, as proposed by Van de Ven et al. [1976]. They assert that the basic distinction between impersonal and personal coordination is that with the personal mode human input is required to make task adjustments. In impersonal coordination, various organizational activities are integrated by using preestablished plans, schedules, formalized rules, and policies and procedures, which do not require human input. Impersonal coordination modes are discussed in the literature with many different labels, including "administrative control" [Bruns and Waterhouse, 1975; Merchant, 1981], "formal controls" [Child, 1975], and "output controls" [Ouchi, 1977]. In personal coordination, human input may take the form of individual intervention or group meetings. An individual or a group serves as the mechanism for making mutual task adjustments through vertical or horizontal channels of communication or through committee meetings.

DEPENDENT VARIABLE: HAIS EFFECTIVENESS

Measuring the effectiveness of information systems (IS) is a perplexing issue that has generated much debate and subsequent research over the years. Although ideally one would like to evaluate the IS effectiveness based on its degree of support for decision making and its resultant productivity benefits, measurement is a difficult task because of the difficulties of tracing and measuring the intermediate effects of MAS. Thus, information systems researchers have developed surrogate measures for IS effectiveness. Examples of these surrogate measures include user information satisfaction [Ives, Olson, and Baroudi, 1983; Jenkins and Ricketts, 1979], system usage [Mann and Watson, 1984; Srinivasan, 1985], and information value [Gallagher, 1974].

User information satisfaction (UIS), measuring users' satisfaction with information quality, is generally recognized as one of the most important indicators of IS effectiveness [Ives et al., 1983; Srinivasan, 1985; Swanson, 1974; and Zmud, 1979]. UIS measures satisfaction of organization members who actually use the IS output to meet their organizational responsibilities. An underlying reasoning of measuring UIS as a surrogate for IS effectiveness is that a direct relation between information quality and individual decision making performance is believed to exist. In general, there is some empirical support for this relation [Porat and Haas, 1969; Streufert, 1973]. Also, a direct link has been identified between organizational goal achievement and the quality of individual decision making [Huber, 1980]. Therefore, users' satisfaction with information quality, a major output of IS, is considered to be a meaningful surrogate for IS effectiveness and is used in this study.

HYPOTHESES

Building upon an understanding of technology and coordination modes, we can explore the best "matches" between these two variables in terms of HAIS development group performance. When the structural contingency theory asserts that there is a relation between technology and structure which predicts a third variable (performance), it is stating that an *interaction* exists between technology and structure [Arnold, 1982; Schoonhoven, 1981]. Thus, a series of interaction hypotheses are developed between individual technology and coordination modes.

Task Predictability

As the frequency of unexpected events increases, it becomes increasingly difficult for an HAIS development group to specify rules, policies, and procedures in advance. If there are few exceptions, system development personnel can learn and apply the prespecified plan of action for each exception. Alternatively, when a less frequently observed event arises, the programmer can consult with a senior systems analyst to determine the appropriate prespecified response. As the number of unexpected events increases, however, there are more situations in which reliance on standardized procedures is inappropriate and less effective. In the extreme case, a high level of uncertainty may require that mutual adjustments be accomplished by group judgments [Van de Ven and Delbecq, 1974]. Accordingly, the following hypotheses are proposed:

H1: Impersonal means of coordination will make a greater contribution to UIS under conditions of high task predictability than under conditions of low task predictability.

H2: Personal means of coordination will make a greater contribution to UIS under conditions of low task predictability than under conditions of high task predictability.

Problem Analyzability

If problems encountered are analyzable, most of the task activities can be standardized and programmed [Litwak, 1961; Perrow, 1970; and Hall, 1972]. However, if problems are not well understood, then during the process of task execution learning takes place, which leads to changes in role allocation, schedules, and priorities [Galbraith, 1973; Perrow, 1967]. Thus, it becomes increasingly difficult to specify rules and procedures to be followed in advance as problem analyzability decreases. Instead, personal means of coordination, which involve on-the-spot sharing of information among system development personnel, are an effective way of dealing with unanalyzable problems. Hence the following hypotheses:

H3: Impersonal means of coordination will make a greater contribution to UIS under conditions of high problem analyzability than under conditions of low problem analyzability.

H4: Personal means of coordination will make a greater contribution to UIS under conditions of low problem analyzability than under conditions of high problem analyzability.

Task Interdependence

The coordination mechanism also varies depending on the level of task interdependence; pooled, sequential, reciprocal, or team. At the pooled level, the little coordination that is necessary when problems arise can be efficiently handled by categorization of problems. At the sequential level, a high degree of mechanization can be utilized to help the coordination process proceed according to plan. However, as task interdependence increases to reciprocal and team levels, it becomes increasingly difficult for an HAIS to specify in advance the behaviors to be followed by organizational members. Personal contact between unit members and group modes will be necessary to make mutual adjustments. The above discussion leads to the following hypotheses:

H5: Impersonal means of coordination will make a greater contribution to UIS under conditions of low task interdependence than under conditions of high task interdependence.

H6: Personal means of coordination will make a greater contribution to UIS under conditions of high task interdependence than under conditions of low task interdependence.

Group Size and Coordination

In addition to technology, the size of the group, defined as the total number of persons employed in a work unit, has been found to be a factor confounding the effect of coordination mode on work unit performance [Hare, 1962; Van de Ven, 1975; Van de Ven et al., 1976]. In general, the growth in group size increases structural differentiation, and subsequently produces a trade-off between high complexity and low coordination burden within work units because activities within a group tend to become more homogeneous [Van de Ven et al., 1976]. To summarize the previous research findings about the relation between group size and coordination modes, as size increases: (1) more mechanical methods are used to control the behaviors of participants in reaching a solution [Hare, 1962]; (2) face-to-face techniques of leadership behavior give way to more impersonal techniques of coordination [Van de Ven, 1975]; (3) group size appears to have an impersonalizing effect on coordination [Van de Ven et al., 1976]. These research findings suggest the following hypothesis:

H7: The impersonal mode of coordination will make a greater contribution to UIS when the group size is larger than when the group size is smaller.

CONFOUNDING VARIABLES

In order to identify the confounding variables that may affect HAIS performance, reference is made to the IS research framework provided by Ives et al. [1980]. The confounding variables examined in this study, as well as their operational measures, appear in Table 1.

IS Environment

The Ives et al. [1980] framework describes IS in terms of its interfaces with an external environment, the organizational environment, and three information system environments (user, development, and operations). The effect of the external environment was held constant by selecting a specific type of organization: not-for-profit hospitals.

TABLE 1

CONFOUNDING VARIABLES[a]

	Threats	How Controlled
Environmental Factors	External	Control over the industry effect since organizations in the same industry are usually exposed to the similar environmental demands
	Organizational	Organizational rank (RANK)[b] of IS director and group size (SIZE)
	User	Matching the management level of primary users
	Development	User involvement (UINV) in IS development and evaluation
	Operations	Top management support (TOP) and coordination modes (independent variables)
Technical Quality of HAIS		Classify the HAIS into six different stages, using Nolan's stage hypotheses (STAGE1-STAGE6):
	IS Content	Data Base Management Systems and data communications
	Timing of presentation	On-line vs. Batch systems

[a] Adapted from Ives, Hamilton, and Davis [1980].

[b] Abbreviations in parentheses are variable names used in statistical analyses.

Regarding organizational environment, the organizational rank (RANK) of the responsible IS executive was selected since empirical research findings clearly support the relations between the rank and IS success [Ein-Dor and Segev, 1982; Olson and Chervany, 1980; and Hammond, 1974]. Ein-Dor and Segev [1978] summarized the previous research findings as follows:

> . . . the likelihood of MIS success declines rapidly the lower the rank of the executive to whom the MIS chief reports, and is virtually negligible more than two levels below the chief officer of the particular organization which the MIS serves. [p. 1074]

The user environment is the environment surrounding and including primary users. Primary users consist of decision makers who use the IS outputs for their decisions. Gorry and Scott Morton [1971] argue that the attributes of required information (e.g., accuracy) vary depending on Anthony's [1965] levels of managerial activity and Simon's [1960] relative degree of structure in the decisions being made. Thus, it may be important to account for differences in information requirements among users.

Regarding primary users of hospital information systems (HIS), Ball and Boyle [1980] concluded in their survey of HIS that the HIS currently emphasizes business-oriented applications:

> In general, they transmit orders, capture a day's charges, prepare the census . . . and frequently allow inquiry into patient financial records on the accounting computer. . . . [p. 16]

Their study indicated that the primary users of HAIS were administrative personnel, and the typical hospital business office accommodated these personnel. Thus, the business office manager was selected as an appropriate user for the HAIS performance evaluation and, thus, different information needs were mitigated.

Concerning the IS development environment, user involvement (UINV) in the development process has been identified as a critical factor to IS success. Based on an extensive literature review, Ives and Olson [1984] summarized that user involvement in IS development improves the chance of IS success by providing a more accurate user information needs, by improving user understanding of the system, by leading to system ownership by users, and by committing users to the system. Thus, user involvement is incorporated.

Concerning the information system operations environment, top management support (TOP) for IS has been identified as a critical factor for IS effectiveness [Maish, 1979; Martin, 1983; and Swanson, 1974].

Technical Quality of HAIS

Ives et al. [1980] also suggest that technical quality of an information system is an important factor for IS effectiveness. Technical quality of an IS can be described in terms of its content (data and decision model) and its time dimension (processing delay and on-line versus offline).

The model used here for measuring technical quality of an IS was developed by Nolan [1979]. In his descriptive "stage model" of computing evolution in organizations, Nolan developed a "technology benchmark test" to evaluate the technical quality of an IS. The test incorporates IS content, a dimension of technical quality, measuring the usage of data base management systems and data communications. To incorporate timing of presentation, the test measures the usage of on-line versus batch processing. Based on the technology benchmark test, an HAIS is classified into one of the six different stages in Nolan's model, ranging from STAGE1 (the least sophisticated) to STAGE6 (the most sophisticated).

In summary, the confounding variables included in the research design are: organizational rank of HAIS director (RANK), top management support (TOP), user involvement (UINV), and technical quality of HAIS (STAGE1 through STAGE6).

RESEARCH METHOD

Using questionnaires, a field survey of HAIS development groups was conducted. The HAIS development function includes the analysis, design, and programming of new applications, and the maintenance of existing applications. Application areas include various administrative tasks such as diagnostic related groups (DRGs), general ledger, accounts payable, payroll, admissions and discharges, materials management, and patient billing.

The Sample

Questionnaires were sent to 91 hospitals that were members of a private national association of HIS.[1] The research objectives required that, in each hospital, the information come from both the HAIS group and HAIS users. Business office managers were chosen to receive the user questionnaire based on the work of Ball and Boyle [1980]. To help ensure a fair evaluation of HAIS performance, the business office managers were contacted independently of the HAIS directors.[2]

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[1] One important characteristic of the member hospitals was that most hospitals were using in-house developed HIS as opposed to vendor-provided software packages.

HAIS directors were asked to complete the questionnaire concerning the confounding variables. HAIS directors were also asked to select randomly five system development personnel and to distribute an HAIS Employee Questionnaire to each of them. HAIS development personnel were asked to complete the questionnaire regarding both their task characteristics and the coordination modes within the HAIS department. The completed questionnaires were directly mailed to the researcher.

Of the 91 hospitals originally contacted, usable responses were received from 28 hospitals for a response rate of 31 percent.[3] Thus, those 28 hospitals comprised the final research sample. To assess nonresponse bias, differences in *UIS* between the hospitals in which the data were collected from *both* groups and the hospitals in which *only the business office manager* responded were tested. There were no significant differences. Hospital size, measured by the number of patient beds, ranged from medium to large: 11 hospitals between 150 and 400 beds, ten between 500 and 850 beds, and seven over 1,000 beds. There were no statistically significant differences in *UIS* among these groups.

Measures

Operationalizations of the dependent and independent variables are summarized in Table 2.

User information satisfaction (UIS) was used to measure HAIS performance. Among many UIS measures, the Jenkins and Ricketts [1979] measure was adapted to measure users' satisfaction with information quality. Seven information attributes of information quality are accuracy, amount of information, format, understandability, usefulness for identifying and resolving problems, and usefulness for selecting among alternative courses of action. Users were asked to circle a number between one and seven that indicated their degree of agreement with each item as a description of each information attribute. The responses to the questions were averaged to achieve an overall HAIS performance score. The Cronbach alpha coefficient was .87.

Technology and coordination modes of HAIS development group were measured on semantic differential scales that indicated HAIS employees' degree of agreement on a description of the work done in their unit and of the work group coordination modes, respectively. The respondents' scores were averaged to obtain organizational scores.

With respect to technology, the two questionnaire scales developed by

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[2] One concern about the independent evaluation, raised by an anonymous reviewer, was that the business office manager could be the immediate supervisor of the HIS director. The direct data about this matter were not collected when the study was conducted. However, indirect data, i.e., organizational rank of HAIS director, were collected. In 23 hospitals out of 28 in the sample, the HAIS director was ranked one or two levels below the CEO. For these hospitals, it is assumed that the business office manager may not be the immediate supervisor of the HAIS director. For the five hospitals where the HAIS director was ranked three or more levels below the CEO, the HAIS director was contacted to find out the hierarchical relation with the business office manager. *No HAIS director* was under the supervision of the business office manager.

[3] The response rates were:

	HAIS Department		
	Response	*Nonresponse*	*Total*
Business Office			
Response	28* (31%)	33 (36%)	61 (67%)
Nonresponse	12 (13%)	18 (20%)	30 (33%)
Total	40 (44%)	51 (56%)	91 (100%)

* Number of hospitals

TABLE 2

OPERATIONALIZATION OF THE VARIABLES

	Dependent Variable	*Independent Variables*
Theoretical Construct	HAIS development group performance	Match between coordination and organizational context such as technology and group size
Operational Definitions	Constituent satisfaction with information quality [User Information Satisfaction[a] (UIS)[b]]	Coordination includes personal (PER) and impersonal (IMPER) coordination modes.[c] Technology includes predictability (PRED), analyzability (ANAL), and interdependence (INTER) of HAIS tasks.[d] Group size (SIZE) is defined as the total number employed in the work unit.
Operational Measures	Seven information attributes measured are (1) accuracy, (2) format, (3) understandability, (4) amount of information, (5) usefulness for identifying and (6) resolving problems, and (7) usefulness for selecting among alternative courses of action.	Task characteristics and coordination modes of HAIS development group are measured on semantic differential scales that indicate HAIS employees' degree of agreement on a description of the work done in their unit and of the group coordination modes, respectively.

[a] Adapted from Jenkins and Ricketts [1979].
[b] Abbreviations in parentheses are variable names used in statistical analyses.
[c] Adapted from Van de Ven et al. [1976].
[d] Adapted from Perrow [1970].

Withey et al. [1983], using a seven-point scale ranging from strongly disagree to strongly agree, were used to measure task predictability (PRED) and problem analyzability (ANAL). The alpha coefficient was .88 for the task predictability and .87 for the problem analyzability. For task interdependence (INTER), the question developed by Mohr [1971] was used. HAIS employees circled a number from one to ten in response to the question. Coordination modes were measured with the questions Van de Ven et al. developed in 1976. Employees were asked to circle a number between one and seven that indicated their degree of agreement with each item as a description of group coordination modes. The alpha coefficient was .74 for the impersonal coordination modes (IMPER) and .83 for the personal coordination modes (PER).

HAIS development group size (SIZE) was measured as the total number employed in the work unit.

RESULTS

Zero-order Correlation Among Variables

Table 3 presents descriptive statistics for the independent and dependent variables, including the zero-order correlations.

As Table 3 shows, the impersonal mode of coordination was highly correlated with task predictability and problem analyzability. That is, as task predictability and problem analyzability increased, the use of such impersonal

TABLE 3
PRODUCT-MOMENT CORRELATIONS AMONG VARIABLES

	Mean	*Standard Deviation*	*Cronbach's Alpha*	*Variable Number*					
				1	*2*	*3*	*4*	*5*	*6*
Performance									
1. User Information Satisfaction (UIS)	5.03	.91	.87						
Technology									
2. Predictability (PRED)	3.22	.77	.88	.31					
3. Analyzability (ANAL)	4.06	.79	.87	.30	.42*				
4. Interdependence (INTER)	3.00	.86	N/A	.33	.18	.20			
Group Size									
5. (SIZE)	14.65	11.45	N/A	−.09	.45*	.06	.22		
Coordination									
6. Impersonal (IMPER)	5.02	.78	.74	.35	.53**	.67**	.21	.15	
7. Personal (PER)	4.57	.65	.83	.36	.37	.28	.00	.19	.58**

N=28 Hospitals
* $p<.05$
** $p<.01$

TABLE 4
REGRESSION ANALYSES OF COORDINATION MODES ON TECHNOLOGY AND GROUP SIZE

	Coordination Modes					
	Impersonal (IMPER)			*Personal (PER)*		
Contingent Variable	β	F-*statistic*	*Probability*	β	F-*statistic*	*Probability*
Technology						
Predictability (PRED)	.479	9.89	.004	−.418	8.52	.007
Analyzability (ANAL)	.676	21.05	.000	.225	1.54	.225
Interdependence (INTER)	−.214	1.22	.279	.137	.57	.455
Group Size						
Group Size (SIZE)	2.223	.61	.441		N/A	

coordination means as formalized rules, schedules, and pre-established plans increased. Group size correlated highly with task predictability.

Hypotheses Testing

The hypotheses were tested using a deviation-score approach [Dewar and Werbel, 1979; Fry and Slocum, 1984]. Proponents of this approach have analyzed the impact of deviations in structure from an ideal context-structure model, in which congruency is defined as adherence to a linear relation between dimensions of context and structure [Drazin and Van de Ven, 1985]. Also, multicollinearity is less of a problem in this approach than in the standard multiple regression procedure using multiplicative interaction terms.[4]

It has been pointed out that in order to statistically test the significance of an interaction term, lower order main effects must be removed from any higher order interaction effects [Cohen, 1978]. Thus, a regression model was developed for each hypothesis; each regression includes the confounding variables discussed earlier and all the lower order terms plus the deviation score.

A three-step procedure was followed for the deviation-score test.

1. Deviation scores were constructed by regressing each coordination mode ($X1$) on each task characteristic and group size ($X2$). For example:

$$X2=a+b^{*}X1+e$$

2. Residuals were calculated from the best-fitting least-square lines. The absolute values of these residuals were used as deviation scores (low

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[4] With standard multiple regression model using multiplicative interaction terms that combines elements of independent variables in the model, the possibility of multicollinearity exists [Blalock, 1979]. Regression coefficients are unreliable [Neter and Wasserman, 1974] and a depressed regression coefficient could lead to a rejection of the interaction model [Althauser, 1971]. This was the case in this study. For example, the correlation between SIZE and IMPER*SIZE was .975 and the correlation between ANAL and ANAL*IMPER was .936. Thus, testing the statistical significance of the regression coefficient of the interaction term is inappropriate.

TABLE 5

MULTIPLE REGRESSION RESULTS FOR H1 AND H2 CONCERNING TASK PREDICTABILITY (PRED)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (1): H1		*Model (2): H2*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.44*	.30	−.49**	.29
2. PRED	−.13	.22	−.04	.23
3. IMPER	.48**	.19		
4. PER			.33*	.18
5. TOP	.17*	.08	.14	.08
6. UINV	.09	.11	.06	.11
7. RANK	−.63***	.15	−.59***	.15
8. STAGE2	.04	.39	.28	.40
9. STAGE3	.45	.45	.37	.47
10. STAGE4	−.18	.40	−.26	.42
11. STAGE5	−.27	.39	−.25	.41
R^2	.70		.67	
Adjusted R^2	.53		.48	
F-statistic (model)	4.03***		3.52**	
$P(F)$	.005		.011	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1.
[2] Absolute values of technology-coordination regression residuals

scores, good fit; high scores, poor fit). For example:

$$\hat{X}2 = a + b{*}X1$$
$$\text{Misfit} = |X2 - \hat{X}2|$$

3. The negative regression coefficient for the deviation score (i.e., the greater the deviation, the lower the performance), reflects its contribution to a regression equation on HAIS performance.[5] For example:

$$\begin{aligned} UIS = a &+ b1{*}|X2-\hat{X}2| + b2{*}X1 \\ &+ b3{*}X2 + b4{*}TOP \\ &+ b5{*}UNIV + b6{*}RANK \\ &+ b7{*}STAGE2 \\ &+ b8{*}STAGE3 \\ &+ b9{*}STAGE4 \\ &+ b10{*}STAGE5 + e \end{aligned}$$

One-tailed tests were used since all of the hypotheses specified the direction of the expected relations. Regression analyses of coordination modes on the contingent variables (technology and group size) are presented in Table 4.

The regression results of testing the interaction hypothesis between task predictability and impersonal coordination modes (H1) appear in Table 5. As hypothesized, the regression results indicated that the coefficient of the residual was significantly different from zero ($t=-1.46, p<.10$). The negative sign of the coefficient indicates that the greater

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[5] STAGE1 was not included in regression equations because no one hospital in the sample belonged to this category.

TABLE 6

MULTIPLE REGRESSION RESULTS FOR H3 AND H4 CONCERNING PROBLEM ANALYZABILITY (ANAL)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (3): H3		*Model (4): H4*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.50	.44	−.17	.32
2. ANAL	−.13	.25	.21	.17
3. IMPER	.51*	.26		
4. PER			.25	.17
5. TOP	.16*	.08	.19*	.09
6. UINV	.08	.10	.08	.11
7. RANK	−59***	.17	−.52***	.17
8. STAGE2	−.17	.43	.13	.40
9. STAGE3	.10	.46	.26	.45
10. STAGE4	−.20	.41	−.15	.43
11. STAGE5	−.34	.41	−.26	.42
R^2	.69		.66	
Adjusted R^2	.51		.46	
F-statistic (model)	3.75***		3.28**	
$P(F)$	.008		.015	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$

[1] Definitions appear in Table 1.

[2] Absolute values of technology-coordination regression residuals

the deviation, the lower the performance. Thus, the congruency between task predictability and impersonal mode of coordination was significantly associated with performance of the system development group in the hypothesized direction.

Results for the interaction hypothesis between task predictability and personal coordination modes (H2) also appear in Table 5. Results indicated that the coefficient of the residual was significantly different from zero ($t=-1.84$, $p<.05$), as hypothesized. Thus, the congruency between task predictability and personal mode of coordination significantly influenced the performance of the system development function in the hypothesized direction when confounding variables are controlled.

In order to test the interaction effects between other contextual factors (ANAL, INTER, and SIZE) and the two coordination modes (IMPER and PER), H3 through H7, five regressions were estimated using UIS as the dependent variable. Contrary to expectations, no significant interaction effects were observed. Thus, H3 through H7 were not supported. Results are presented in Tables 6, 7, and 8.

DISCUSSION

The results suggest that the congruency between task predictability and coordination modes of HAIS develop-

TABLE 7

MULTIPLE REGRESSION RESULTS FOR H5 AND H6 CONCERNING TASK INTERDEPENDENCE (INTER)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (5): H5		*Model (6): H6*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.27	.42	−.40	.34
2. INTER	−.15	.21	.02	.21
3. IMPER	.43**	.18		
4. PER			.33*	.16
5. TOP	.18*	.09	.12	.09
6. UINV	.08	.10	.07	.11
7. RANK	−.61***	.16	−.56***	.12
8. STAGE2	−.18	.43	.02	.43
9. STAGE3	.17	.45	.36	.46
10. STAGE4	−.20	.47	.01	.48
11. STAGE5	−.34	.42	−.27	.43
R^2	.68		.66	
Adjusted R^2	.49		.46	
F-statistic (model)	3.65***		3.30**	
P(*F*)	.009		.014	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$

[1] Definitions appear in Table 1

[2] Absolute values of technology-coordination regression residuals

ment group significantly affected HAIS user information satisfaction. This implies that the appropriateness of various coordination modes depends on task predictability. When HAIS development tasks are predictable, the use of impersonal means of coordination, such as rules, plans, and policies, is most appropriate. These coordination methods are both less expensive than personal coordination methods and appear to be more associated with constituent satisfaction. Also, the use of personal means of coordination appears to be appropriate in HAIS development groups experiencing low task predictability.

Contrary to expectations, the congruency between various coordination modes and such contextual factors as problem analyzability and task interdependence were not significantly associated with UIS. One possible explanation is that the data may not have enough variation to test these interaction hypotheses. Considering the lengthy history of HAIS, one would expect to find most of them at the "maintenance" stage in the system development life cycle. In the maintenance stage, projects may be simple enough to allow one person to handle identification of errors and proposed enhancements, analysis, performing changes, and testing, and, thus, only require low level of task interdependence. Also, as an HAIS accumulates experience with the system, un-

TABLE 8
MULTIPLE REGRESSION RESULTS FOR H7 CONCERNING GROUP SIZE (SIZE)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Group Size (SIZE)	
	Model (7): H7	
Independent Variables[1]	B-*Value*	*Standard Error*
1. Misfit[2]	.00	.03
2. SIZE	−.00	.01
3. IMPER	.41**	.18
5. TOP	.18*	.09
6. UINV	.07	.11
7. RANK	−.61***	.17
8. STAGE2	−.00	.43
9. STAGE3	.24	.46
10. STAGE4	−.09	.45
11. STAGE5	−.21	.41
R^2	.67	
Adjusted R^2	.47	
F-statistic (model)	3.40**	
P(*F*)	.013	

N=28
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1
[2] Absolute value of technology-coordination regression residuals

analyzable exceptions may become analyzable through the learning process. If most hospitals in the sample are at the maintenance stage of HAIS, there may not be enough variation in INTER and ANAL to test the interaction hypotheses. In order to assess this possibility, the data on HAIS development technology were reexamined. It was found that only low to moderate interdependence in the sample, with 20 out of 28 indicating low. Regarding problem analyzability, moderate to high analyzability was observed, with 22 HAIS indicating moderate. Thus, inadequate variation in the data may explain the insignificant interactions.

Some specific results about confounding variables are worth noting. The negative relation between the organizational rank of the HAIS director and performance supports a proposition that the higher the organizational rank of the responsible IS executive, the higher the IS performance. Also supported is the proposition that top management support for IS functioning is necessary for IS success. The results regarding the technical sophistication of IS tend to support previous research findings [Cheney and Dickson, 1982] in that IS performance is not influenced much by technical sophistication. For the HAIS practitioner, the current results suggest the need to worry less about how sophisticated the system is, and worry more about how HAIS employees are managed and how organizational support for HAIS can be achieved.

CONCLUSION

This study examined the relation between (1) various coordination modes and three technology dimensions and group size as contextual factors, and (2) the impact of that relation on the functioning of HAIS development groups. The approach to testing structural contingency theory used here has several advantages over previous approaches. First, the effect of confounding variables was controlled to rule out alternative explanations. Second, the study examines the contingency relation at the work group level, i.e., HAIS development group, where technology can best be applied. Further, independent user evaluation of HAIS performance minimized the problem of respondent source bias.

Regarding different research approaches, Drazin and Van de Ven [1985] classified three approaches to "fit" in structural contingency theory—the selection, interaction, and systems approaches. This study used the interaction approach which defines "fit" as the interaction of pairs of organizational context-structure factors. In the selection approach, "fit" is a premise underlying a congruence between context and structure. In the systems approach, "fit" is the internal consistency of multiple contingencies and multiple structural characteristics. Different approaches and a different sample might help refine understanding of the context-structure relation in MAS design and make further improvements in MAS management.

Finally, this study used UIS as a surrogate measure for MAS performance. However, Srinivasan [1985], examining the relations between UIS and IS usage as surrogate measures of system performance, found that the two are not always positively associated. He suggested that researchers be careful about using surrogate measures of IS performance and specifying clearly the exact nature of the dependent variables. This study utilized UIS as a surrogate measure for IS performance and, thus, the results may hold only in the limited context of UIS.

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NOTES

An Experimental Study of the Effects of Audit Structure in Uncertain Task Environments

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ABSTRACT: This study was designed to provide empirical evidence on the effects of audit structure on audit judgments. Specifically, the study examined differences between structured and unstructured audit methods in terms of judgment consensus and auditors' use of coordination and control mechanisms, under different degrees of task uncertainty. A field experiment was conducted involving 113 audit seniors from four firms: two from each end of an audit structure scale. Contrary to expectations, auditors from structured firms did not exhibit uniformly greater consensus in their judgments. However, relative to unstructured firms' auditors, the auditors from structured firms exhibited a greater propensity to *increase* their use of certain control and coordination mechanisms (especially consultation with peers and audit managers) as the level of task uncertainty increased.

CUSHING and Loebbecke [1986] identified an important characteristic of accounting firms' audit methodologies: the degree to which the firms use structured audit approaches. They concluded that firms differ considerably along this continuum, but also noted a trend towards greater audit structure. Though the appropriateness of increasing the degree of audit structure has been debated, little relevant empirical evidence is available. Accordingly, this paper examines relations between audit structure and (1) judgment consensus (i.e., consistency across auditors), and (2) auditors' propensity to utilize coordination and control mechanisms (such as consultation with peers and specialists) in their decision processes. Since effects of audit structure may not be constant across task settings, these relations are examined across tasks that differ in terms of the uncertainty they present.

The diversity of opinions on the benefits of increased audit structure suggests a need to empirically assess audit structure's effects on audit judgment pro-

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cesses and outcomes. Cushing and Loebbecke [1984, p. 11] call for empirical research to "... test the impact of structured techniques on auditor decision making." The impact on judgment consensus seems an appropriate starting point, given that improved within-firm consistency is frequently cited as a major benefit of more structured approaches (e.g., Ashton [1983]; Cushing and Loebbecke [1986]).[1] This potential benefit, though plausible, has not been empirically confirmed. Similarly, the relation between audit structure and use of other coordination and control mechanisms has not been empirically examined. While the coordination and control aspects of increased structure may reduce the need for other mechanisms, it is also possible that incompatibilities between the structured approach and audit judgment situations may cause field auditors to increase their reliance on other, more flexible, mechanisms.

The paper is organized as follows: The next section presents our conceptualization of audit structure, since the meaning of "structured audit methodology" is subject to some debate (e.g., Sullivan [1984]; Mullarkey [1984]). This section also develops three hypotheses about the relations between audit structure and the responses of field auditors under varying levels of task uncertainty. Following sections describe the study's method (a field experiment) and present the results. The final section offers some conclusions, limitations, and implications that follow from the study.

THE CONCEPT OF AUDIT STRUCTURE

The classification of firms along a structured-unstructured continuum was not the primary objective of Cushing and Loebbecke's [1986] research. It emerged from a broader undertaking: the comparison of firm-specific audit models to the normative model implied by generally accepted auditing standards. Perhaps as a result, Cushing and Loebbecke did not define audit structure as a uni-dimensional construct: it encompasses use of both (1) a systematic approach, and (2) audit tools. Furthermore, the definitions used by both Cushing and Loebbecke [1986] and Kinney [1986] are couched in auditing-specific terms, rather than traditional organizational constructs. We have no quarrel with these (operational) definitions of audit structure, and indeed, accept them for our subsequent empirical examination. However, consideration of the traditional organizational constructs of structure and technology should enhance our understanding of audit structure, and help integrate the auditing research with related organizational behavior research.

The relation between audit structure and traditional organizational constructs rests on two propositions. First, audit structure concerns the *structuring* of audit tasks, as distinct from the organizational structure within which those tasks are performed. Second, auditors' behaviors are prescribed and restricted through *formalization*, defined as (1) the existence of rules and procedures, and (2) "the organization's exercise of control to enforce those rules and procedures" [Fry and Slocum, 1984, p.

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[1] Ashton [1983, p. 48] summarized the views of proponents of more structured methodologies: although audit evidence may be "soft," it is preferable "... to integrate that evidence by a more formal, explicit system than by subjective judgment alone, largely in order to achieve more consistent decisions over time and across auditors." However, misgivings have been expressed about the impact of increased structure upon auditor judgment. For example, Sullivan [1984, p. 64] argued that structured methodologies may be associated with a tendency to ignore qualitative evidence, and that some audit judgments are "... not subject to a structured methodology or a quantitative model." Also see Dirsmith and McAllister [1982a,b].

226]. Together, these propositions lead to a definition of audit structure (or more precisely, audit structuring) as the extent to which auditors' task-related behaviors are subject to formalized prescriptions and restraints.

In its fullest form (and one not used in current practice), audit structure entails a "blueprint" for the field auditor's performance of the audit task. This blueprint: (1) identifies audit sub-tasks and the steps and procedures to be followed in their performance, (2) specifies the way the field auditor should integrate the sub-tasks, and (3) genuinely prescribes and restricts behavior (i.e., the field auditor lacks the discretion to choose to ignore the blueprint's specifications). Under weaker forms of audit structure, sub-tasks and their integration may not be specified (at least not systematically and comprehensively) and/or field auditors may exercise considerable discretion in their approach to the audit. In short, unstructured approaches may provide field auditors with guidelines and aids, but fall well short of providing a blueprint.

This definition of audit structure makes no reference to audit *technology* (e.g., decision aids and audit tools). Highly structured firms may be more likely to use decision aids and audit tools, since they offer an efficient means for prescribing audit processes and behaviors. However, the mere availability of these technologies does not connote a high degree of audit structure: their contribution to structuring depends on the extent to which they are formally integrated and prescribed within the audit process. Furthermore, auditors' perceptions of audit task technology are likely to be affected by the degree to which behaviors are formally prescribed. In particular, auditors from firms with a highly structured approach are likely to perceive their tasks as more routine (i.e., less varied and more analyzable) than auditors from firms using less structured approaches. This expectation, and the anticipated association between audit structure and formalization, are empirically examined in this study.

Expected Effects of Audit Structure and Uncertainty

A primary motive for introducing increased structure is to improve the consistency of judgments made in similar settings. Accordingly, in appropriate task settings, judgment consensus among auditors from structured firms (hereafter referred to as structured firm auditors) should exceed that among auditors from unstructured firms (hereafter referred to as unstructured firm auditors). Appropriate task settings are characterized by low or modest uncertainty. These task settings allow for advance identification of appropriate procedures and responses and, hence, are conducive to developing and applying a blueprint. As a consequence, structured firm auditors who are accustomed to following the same formally prescribed approach should exhibit a relatively high degree of consensus:[2]

> H1: Judgment consensus among structured firm auditors exceeds consensus among unstructured firm auditors, in low or modest uncertainty task settings.

The effects of audit structure upon consensus may not be the same across all audit settings, however. An appropriate "fit" between the structured audit methodology and task requirements (and, hence, consensus) becomes questionable with increasing task uncertainty [Bamber and Bylinski, 1982].[3] Even if structured firm auditors recognize the inappropriateness of a structured approach to a given task, difficulty in adapting their approach may result in a more adverse effect upon the judgment consensus of these auditors:

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[2] Greater consensus is expected *within* structured firms, but not necessarily *across* structured firms. This is because particular audit approaches may still differ across firms whose audit methods are highly structured.

H2: Judgment consensus among structured firm auditors is more adversely affected by increased task uncertainty than is the consensus among unstructured firm auditors.

The above discussion questions the "fit" between structured audit approaches and uncertain audit tasks. However, various mechanisms can provide increased flexibility to achieve the necessary "fit." These coordination and control mechanisms are used in differing degrees by auditing firms [Bamber and Bylinski, 1982]. Mechanisms to overcome inflexibility and deal with high uncertainty should be of special interest to firms using structured methods. Specialists and consulting partners, for example, may enable the auditor to recognize, and appropriately adjust for, the lack of "fit" between the formalized audit program and an uncertain audit task. Consequently, increased task uncertainty should increase structured firm auditors' use of such mechanisms more than it does for unstructured firm auditors:

H3: Structured firm auditors' propensity to use coordinating and control mechanisms increases more strongly with increased task uncertainty, than is the case for unstructured firm auditors.

METHOD

Subjects

One hundred and thirteen practicing auditors from four "Big Eight" firms participated in the study. To reduce potential office effects, three (and in one case, four) offices from each firm provided subjects. The auditors had one to six (average 3.2) years of experience. This experience level was chosen because structured approaches are aimed at directing field efforts of staff, seniors, and supervisors. We met with each office's managing partner or another liaison person, worked through the test instrument with that person, and arranged for distribution and return mailing of the completed test instruments. Each subject sealed the completed test instrument in an attached envelope and returned it to the liaison person for mailing.[4] These procedures resulted in a response rate of close to 100 percent.

Independent Variables: Audit Structure and Uncertainty

Audit structure is a between-subject variable, controlled by selecting auditor-subjects from firms known to fall at each end of Cushing and Loebbecke's [1986] structure scale. The categorization of the four firms is supported by Kinney's [1986] findings, and by inference, corresponds with Cushing and Loebbecke's classification.[5] Additional steps ensured that the audit structure variable was captured by this approach. First, an ancillary purpose of the pretest (involving audit seniors and managers) was to verify that differences in audit structure existed across firms. Each firm (but not all offices) participated in the pretest. Second, the experiment's debriefing questionnaire included scales designed to measure both technology and formalization. These measures are based on the perceptions of respondents (the participating auditors), as distinct from Cushing and Loebbecke's "institutional" measures.[6]

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[3] In the audit setting, task uncertainty may result from (1) task characteristics (where complexities inherent in the task, e.g., the materiality judgment, prevent specifying the relations between all task components), or (2) the task environment (where unique or dynamic client circumstances make appropriate procedures and responses too numerous to document in advance). This results in an incomplete blueprint of the audit process.

[4] This assured subjects of some confidentiality. Wright [1976] discusses problems and tradeoffs associated with this study's approach to administering the instrument. For example, subjects may have discussed the case with others.

[5] Kinney [1986, p. 83] indicated that his rankings were consistent with those of Cushing and Loebbecke [1986]. Confidentiality assurances given to offices participating in the current study preclude identification of firms by name.

The *technology* scale was developed by Daft and Macintosh [1981]. Like Perrow's [1967] conceptualization of technology, on which this scale is based, it is the sum of two subscales. First, *task variety* (five items) measures the frequency of unexpected and novel events. Low variety means there is considerable certainty about the occurrence of future activities. Second, *task analyzability* (six items) concerns the way in which individuals respond to problems that arise. An objective computation procedure is available for analyzable tasks; for other tasks, time must be spent thinking about what to do, and active search for solutions beyond normal procedures may be required.

As discussed earlier, formalization is an organizational structure dimension distinct from the technology dimension. The degree of *formalization* was assessed via the formalization scale (eight items) from House and Rizzo's [1972] organizational practices questionnaire. They define the scale as "the degree to which standard practices, policies, and position responsibilities are formalized explicitly" [House and Rizzo, 1972, p. 391].

Prior research suggests that both the technology and formalization scales possess satisfactory construct validity and reliability in a variety of settings. Based on Campbell and Fiske's [1959] validation technique, Withey et al. [1983] identified Daft and Macintosh's [1981] technology scale as one of the better instruments. Similarly, House and Rizzo [1972] concluded that their formalization scale met the requirements for validity and reliability. We examined reliability by means of Cronbach's [1951] coefficient α. The resulting coefficients for task analyzability ($\alpha=.71$) and formalization ($\alpha=.72$) are similar to those typically reported in the organizational literature, suggesting the measures are acceptable for testing differences between firms. However, the coefficient for task variability ($\alpha=.40$) suggests that this scale contains considerable error variance.[7]

Uncertainty is manipulated as a three-level, within-subject variable. The experimental task relates to the confirmation of accounts receivable: a standard audit procedure which, because of its well-defined task characteristics, may be described as possessing relatively low task uncertainty. However, the sub-tasks (e.g., expected error and tolerable error determination) in the confirmation sample size decision are not so well defined, and they are used to distinguish the first two levels of uncertainty. The client has two distinct types of customers and keeps separate records for each category of receivables. One receivables category represents the relatively low uncertainty treatment level. The added uncertainty in the second treatment level is operationalized in terms of deteriorating industry conditions and unexpectedly negative compliance test results.[8]

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[6] The Cushing-Loebbecke measures were based on reviews of firm audit manuals and related documents, and discussions with "key informants."

[7] Consequently, the task variability scale is unlikely to show significant differences even if firms do differ on the dimension.

Despite the added uncertainty in treatment level two, the well-defined nature of the confirmation sample size task makes it conducive to a structured audit approach. Consequently, the third treatment level introduces additional task uncertainty so that structured and unstructured firm auditors are placed on equal footing. Increased uncertainty is introduced by providing ambiguous confirmation results for the second receivables category:

> As well as a *number of non-responses, there are several exceptions returned.* None of these exceptions was adequately resolved. No other testing of receivables has been performed.
>
> *Assume* that you find the results of the confirmation procedure unsatisfactory, although a projection to the population of the exceptions identified (i.e., before considering sampling risk) does not result in a significant overall error in the receivables' balance.

In effect, this adds another level of incomplete information (i.e., the ambiguous confirmation results) and the auditor's task is to decide what to do next. Moreover, response uncertainty is heightened by giving subjects the option of adjusting the nature and timing of the follow-up procedures, as well as increasing the sample size (i.e., increasing the extent of sampling).

Dependent Variables

The primary dependent variable is the auditor's *sample size judgment* for accounts receivable confirmations. Most auditors are highly familiar with this task and, as noted earlier, it is conducive to a structured approach. Indeed, both of the structured firms (but neither of the unstructured firms) provide specific guidance for computing this sample size.[9] However, both structured and unstructured firms provide the opportunity to use statistical sampling techniques. Finally, the sample size judgment provides a direct measure of the extent of audit effort, and variability in sample size judgments provides a meaningful measure of consensus [Mock and Turner, 1981; Biggs and Mock, 1983; and Tabor, 1983].

The pretesting phase identified information that subjects would need to use their firm's techniques and decision aids for the judgment task. In addition to this information, the test instrument also included information that the AICPA audit and accounting guide, *Audit Sampling* [1983], suggests be considered in substantive testing. A potential problem in requesting sample size judgments in experimental settings is that subjects may choose not to use the statistical sampling programs that they would normally use in practice. However, preliminary discussions with firm representatives suggested that, as presented, the sample size decision would be a reasonable task for the statistical samplers.[10]

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[8] Although the changing industry conditions and unexpectedly negative compliance test results will undoubtedly increase inherent and control risks (and, hence, confirmation sample size), they will also increase task uncertainty. The dynamic characteristics of the changing industry conditions, and especially the unexpected compliance test results, will contribute to increased uncertainty in the performance of the sub-tasks (i.e., assessing the factors affecting sample size). Of interest here is whether this increased sub-task uncertainty is reflected in increased sample size dispersion (i.e., lack of consensus). In particular, H2 hypothesizes that this increase in subtask uncertainty will more adversely affect structured firm auditors' consensus relative to unstructured firm auditors' consensus.

[9] Additional discussion of differences between structured and unstructured firms' practices is presented below.

[10] Note that reliance on statistical sampling is "balanced" across our structured and unstructured firms. The pretesting phase indicated that one structured firm *and* one unstructured firm (at least in the participating

TABLE 1

TESTS FOR DIFFERENCES BETWEEN STRUCTURED AND UNSTRUCTURED FIRMS, BASED ON ORGANIZATIONAL MEASURES OF FIRMS' AUDIT APPROACHES

	Firm[b] *Mean*				*One-Way ANOVA*[c]	
Organizational Scale[a]	*S1*	*S2*	*U1*	*U2*	F-*Ratio*	*Probability*
Technology:						
Task Variety	3.11	3.22	3.29	3.20	.92	.340
Task Analyzability	2.51	2.52	2.91	2.64	8.46	.006
Combined-Routineness	2.81	2.87	3.10	2.92	7.12	.009
Formalization	3.87	3.81	3.64	3.73	2.45	.120

[a] Measures were based on subjects' responses (on five point scales) as to their agreement with various statements. Higher scores mean more variety, less analyzability, less routineness, and more formalization.

[b] The two structured firms are labeled S1 and S2 and the two unstructured firms are labeled U1 and U2.

[c] Similar results were obtained with firm (four levels) instead of structure (two levels) as the independent variable.

A series of communication alternatives captured the second dependent variable: the use of *coordination and control mechanisms.* As well as providing sample sizes, subjects also indicated the likelihood (based on five-point anchored response scales) that they would consult various sources before making the sample size decision.[11] The specific questions were:

> Would you refer to a firm audit manual to help you decide on the details of the sampling procedure?
>
> Would you discuss with a peer (i.e., another senior) the details of your sampling procedure?
>
> Would you consult the engagement manager on the details of your sampling procedure?
>
> Would an engagement team conference (i.e., senior, manager, and partner) be held on the details of your sampling procedure?
>
> Would you consult with a firm-designated sampling expert on the details of your sampling procedure?

RESULTS

This section begins with findings concerning differences between structured versus unstructured firm auditors in terms of (1) subjects' perceptions of their firms' organizational characteristics (i.e., technology and formalization), and (2) subjects' selection of a sampling approach (an important component of audit technology). We then briefly assess the uncertainty manipulation before presenting results relating to the study's three hypotheses. The effects of audit structure on consensus and the use of coordination and control mechanisms are reported. Hereafter, the two structured firms are referred to as S1 and S2 and the unstructured firms as U1 and U2.

Characteristics of Structured versus Unstructured Firms

Perceptions of Technology and Formalization. Table 1 presents firm means

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offices) were relatively frequent users of statistical sampling computer packages. This supports our earlier distinction between technology and audit structure.

[11] These communication alternatives are based on the contingency view of organizations [Galbraith, 1973; Tushman and Nadler, 1978] and, in particular, specific coordination and control mechanisms commonly employed by accounting firms.

TABLE 2

SUBJECTS' INDICATED SAMPLING APPROACHES FOR THE FIRST AND SECOND LEVELS OF UNCERTAINTY[a]

Firm	*Statistical*	*Decision Aid*	*Nonstatistical*	*Other*
		Uncertainty Level One[b]		
S1	2	24	—	—
S2	24	5	—	—
U1	19	4	5	1
U2	4	13	11	—
		Uncertainty Level Two[b]		
S1	2	24	—	—
S2	26	2	—	—
U1	19	5	4	1
U2	7	9	11	1

[a] Table entries are the *number of subjects* indicating they would use each sampling approach.

[b] Chi-square statistics with "Other" category omitted are 73.6 ($p<.001$) for uncertainty level one, and 77.0 ($p<.001$) for uncertainty level two. One subject at level one (from firm S1) and two subjects at level two (from firms S1 and S2) did not respond to the question.

for the technology and formalization scales, and one-way analysis of variance (ANOVA) results for the effect of structure. Differences between structured and unstructured audit methodologies are statistically significant for task analyzability ($F=8.46$, $p<.006$) and the combined (routineness) scale ($F=7.12$, $p<.009$). As expected, members of unstructured firms (U1 and U2) tended to view their tasks as less analyzable and less routine. For formalization, the difference is marginally significant ($F=2.45$, $p<.12$), and in the expected direction. Subjects in the unstructured firms believe they are relatively less subject to formal rules and procedures. These results are entirely consistent with Cushing and Loebbecke [1986] and support their institutionally derived audit structure scale.[12]

Sampling Approaches. As discussed earlier, structured audit methodologies are not synonomous with a particular sampling approach such as statistical sampling. However, because the approach to sample size determination is an important element of an audit method, subjects were asked to indicate the approach they would likely use. Table 2 indicates that there is not a one-to-one mapping between sampling approach and structure. Differences between firms are apparent, and the chi-square statistic is significant ($p<.001$) at both levels of uncertainty.

The actual differences between firms are greater than those suggested by Table 2. For example, while subjects from a structured firm (S2) and an unstructured firm (U1) are both likely to use a statistical sampling approach, firm U1 makes available a statistical sampling package with options for various types of statistical sampling. On the other hand,

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[12] Admittedly, the differences between the firm means reported in Table 1 are not large and, moreover, the associated one-way ANOVAs (also in Table 1) have coefficients of determination of .1 or less. However, the study's objective was not to explain subjects' perceptions, but to test whether an alternative method (i.e., a survey of seniors' perceptions) would support the differences identified by Cushing and Loebbecke [1986].

TABLE 3

CENTRAL TENDENCY AND DISPERSION IN SAMPLE SIZE JUDGMENTS—BY FIRM AND UNCERTAINTY LEVEL

A. Measures of Central Tendency by Firm and Uncertainty Level.

Uncertainty Level	*Firm Mean (Median)*[a]			
	S1	*S2*	*U1*	*U2*
1	50	29	47	46
	(42)	(25)	(47)	(40)
2	71	50	60	67
	(66)	(40)	(56)	(60)
3	79	69	69	78
	(66)	(42)	(64)	(60)

B. Measures of Dispersion by Firm and Uncertainty Level.

Uncertainty Level	*Firm Standard Deviation (Interquartile Range)*[b]			
	S1	*S2*	*U1*	*U2*
1	24.9	13.8	27.0	12.4
	(31.5)	(22.0)	(31.3)	(20.0)
2	27.6	34.6	28.3	19.3
	(17.5)	(50.5)	(25.8)	(20.0)
3	26.9	57.3	31.7	34.5
	(43.0)	(84.0)	(30.0)	(30.0)

[a] The increase in sample size from uncertainty level one to uncertainty level two is statistically significant for each firm ($p<.01$), using both paired-comparison t-tests and paired replicates sign tests.

[b] There is a statistically significant difference in firms' sample size dispersion at each level of uncertainty under Bartlett's F-test ($p<.05$) and the nonparametric [Conover et al., 1981] F-test ($p<.1$).

firm S2 focuses on one specific type of statistical sampling which is integrated with other parts of the audit, and includes in its audit manual a simple formula for manually calculating the sample size. Also, firm S1's decision aid involves a step-by-step determination of sample size, while firm U2's decision aid only lists factors that should be considered (subjectively) in arriving at a sample size. In sum, these results support the Table 1 perception-based data in suggesting that there are meaningful differences between firms' audit methods.

Uncertainty Manipulation

Panel A of Table 3 presents the results of the preliminary test for the effects of uncertainty on subjects' sample sizes. While the primary concern is the effect of uncertainty on consensus (i.e., the dispersion in sample sizes), the manipulation should also lead to increased sample sizes. Uncertainty level is statistically significant ($t=8.53$, $p<.001$), with the overall mean sample size increasing from 43 at uncertainty level one to 62 at level two.[13] Moreover, Table 3's results show that both structured and unstructured firm auditors responded to the manipulation.[14]

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[13] The third treatment level is not included in this test, since it is not directly comparable to the first two levels: the task differs and there is a wider range of available responses at uncertainty level three.

Consensus

The hypotheses were that for tasks of low or modest uncertainty, structured firm auditors would exhibit greater consensus than unstructured firm auditors (H1), and that increases in task uncertainty would have a more adverse impact on consensus among structured firm auditors (H2). To analyze differences between firms, we used two measures of dispersion, the standard deviation and the interquartile range, with associated parametric and nonparametric significance tests.[15] The results appear in panel B of Table 3 and, to facilitate between-firm comparisons, Figure 1 plots firms' interquartile ranges over the three uncertainty levels.

Despite some differences between the two measures of dispersion, Table 3 and Figure 1 indicate that, at low or modest task uncertainty, structured firm subjects do not exhibit greater consensus than unstructured firm subjects. Both tests for differences in dispersion indicate that statistically significant differences between firms exist at each level of uncertainty. However, these differences are not readily explained by the structured/unstructured dichotomy. At uncertainty level one, for example, multiple comparisons of firms' variances indicate that firms S2 and U2 have smaller variances than firms S1 and U1.[16] These results suggest that a structured audit method may not be uniquely associated with greater sample size consensus.

Consensus Under Higher Uncertainty. Because of possible inflexibilities associated with a structured approach, H2 posited that higher levels of task uncertainty would more adversely affect consensus of structured firm subjects. Evidence on this hypothesis is mixed. Tests for differences in dispersion between the first and second uncertainty levels indicate a statistically significant ($p<.01$; by both parametric and nonparametric F-tests) increase in dispersion for firm S2, but not for the other firms. Figure 1 illustrates this result.[17] Moreover, at the third level of uncertainty, multiple comparison analysis shows that firm S2 has significantly larger dispersion than the other three firms. Consequently, the results for firm S2 (but not S1) are consistent with H2.

Under the third level of uncertainty, subjects could change the nature, extent,

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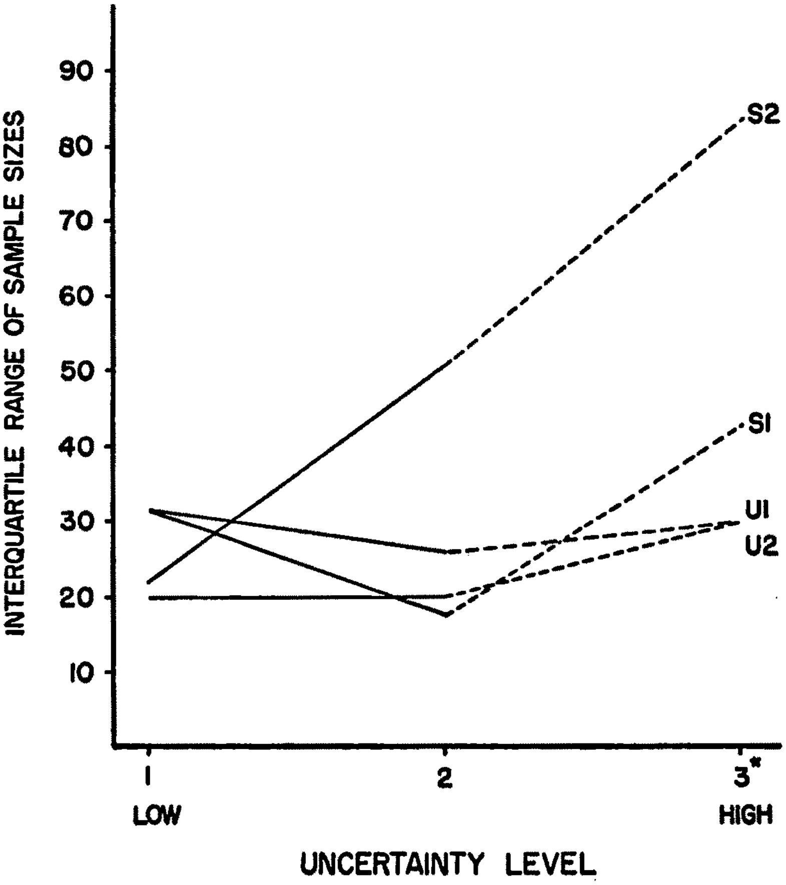
[14] The differences between mean sample sizes across firms evident in Table 3 are also statistically significant. Two-way ANOVA's at each level of uncertainty indicated a statistically significant firm effect at both levels of uncertainty ($F=13.97$, $p<.001$, and $F=5.26$, $p<.002$, respectively) and a statistically significant sampling approach effect at the first level of uncertainty ($F=9.15$, $p<.001$). Analysis also revealed that *within* firms, statistical sample sizes tended to be the largest, followed by those determined via a decision aid. The nonstatistical sample sizes were the smallest. The extent of sampling was not consistent across firms, however, and the firm most reliant on statistical sampling (S2) had the lowest mean sample sizes.

[15] In addition to Bartlett's (parametric) test for homogeneity of variances [Winer, 1971, pp. 208–210], a nonparametric test was used. This test entailed calculating an F-statistic on the normalized rank scores, where rank scores for each firm were computed by taking the rank of the absolute value of the difference between each subject's sample size and the firm median sample size. For a general discussion of the use of ranks in tests for homogeneity of variances, see Conover [1980, pp. 239–284]. The specific test employed was the Conover et al. [1981] procedure "$T-G$: med F."

[16] The Bonferroni multiple comparison method [Neter and Wasserman, 1974, pp. 480–482] was used here and in subsequent multiple comparisons to control the significance level for the family of comparisons. An experimentwise error of .12 was selected, yielding a per comparison error rate of .02 (given the six contrasts involved in comparing four firms).

[17] The reduction in interquartile range between the first and second uncertainty levels for firm S1, although not statistically significant, is contrary to H2. This result appears to be due to a subset of subjects planning not to rely on internal control at any treatment level (and, thereby, specifying relatively large sample sizes at each level of uncertainty). This response may reflect subjects' experiences: they typically audit small clients.

FIGURE 1
FIRMS' SAMPLE SIZE INTERQUARTILE RANGES—
BY LEVELS OF UNCERTAINTY



* In addition to a change in sample sizes, subjects had alternative procedure choices available at the third uncertainty level.

and timing of the confirmation procedures. Slightly more than 40 percent of all subjects favored expansion of scope. This percentage was higher within the structured firms (S1, 42.3 percent; S2, 55.2 percent) than within the unstructured firms (U1, 37.9 percent; U2, 28.6 percent), and this difference is significant (chi-square=2.692) at the .10 level. For subjects who would expand the scope, however, there were minimal differences between firms in terms of changing the timing of the audit procedures and changing the sampling approach. Subjects generally pointed to a change only in the timing of additional confirmations.[18] In sum, the mixed results at uncertainty level three provide no consistent evidence that increased uncertainty more adversely affected consensus within structured firms.

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[18] Subjects could also list alternative procedures they would likely perform. Not surprisingly, many subjects indicated they would test subsequent cash receipts and/or would conduct further analysis of exceptions. Again, no major between-firm differences were apparent from subjects' selection of alternative procedures.

Coordination and Control Mechanisms

H3 hypothesized that (relative to unstructured firm auditors) structured firm auditors' propensity to use coordination and control mechanisms would increase more sharply in response to increased task uncertainty. To test H3, frequency tables were constructed for each dependent variable (i.e., each of the questions listed in the method section) and for each level of uncertainty. Table 4 summarizes this data and shows, for each question, subjects' mean propensity to consult that control and coordination mechanism. The table values show subjects' mean reponses by firm and uncertainty level, and the response scale was anchored such that 1 = highly unlikely to consult that mechanism, and 5 = highly likely to consult. The table also reports the results of chi-square tests for response differences between structured versus unstructured firms.[19]

On average, subjects in each firm were more likely to use coordination and control mechanisms as uncertainty increased. The uncertainty independent variable is statistically significant in all cases (cross-classified chi-square test, $p < .10$).

The results in Table 4 support H3 in that the interaction between uncertainty level and structure is statistically significant for two mechanisms: consultation with peers (chi-square = 6.05, $p < .049$) and consultation with the audit manager (chi-square = 6.71, $p < .035$). Consistent with the pattern of firm means in Table 4, multiple comparison tests indicated that the significant interaction resulted from the increased use (between uncertainty levels two and three) of the mechanisms by structured firm auditors. Examination of the structured versus unstructured frequency statistics in Table 4 further supports H3. While no statistically significant differences between frequencies exist at uncertainty level three, such differences do exist at uncertainty levels one and two for peer consultation (chi-squares of 8.941, $p < .063$; and 10.575, $p < .032$, respectively), and at uncertainty level two for audit manager consultation (chi-square = 11.775, $p < .019$). Hence, structured firms' auditors are, on average, less likely to use these mechanisms under low or moderate uncertainty, but their use of the mechanisms increased considerably under high uncertainty.

LIMITATIONS, CONCLUSIONS, AND IMPLICATIONS

Several limitations of the present study should be noted. First, the time and setting when the research instruments were completed was not under the researchers' control. Second, subjects may have chosen not to access statistical sampling programs that could have affected task performance of auditors who rely heavily on statistical sampling. Third, although task uncertainty was manipulated, the results are based on a familiar, relatively well-defined audit task.

Several primary conclusions emerge from the study. First, unstructured firm auditors perceive their tasks as less analyzable and less routine than structured firm auditors, supporting the Cushing-Loebbecke concept of audit structure. However, contrary to expectations, subjects from firms emphasizing

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[19] The cross-classification chi-square statistics are based on the SAS [1985] CATMOD procedure. The repeated measures analysis of categorical data option in SAS [1985, pp. 177ff.] permitted simultaneous testing for the effects of uncertainty, structure, and their interaction.

TABLE 4

SUBJECTS' PROPENSITY TO USE VARIOUS COORDINATION AND CONTROL MECHANISMS—BY FIRM

Mechanism Consulted	*Uncertainty Level*	*Firm*				*Structured vs. Unstructured Chi-square Significance Level*[a]	
		S1	*S2*	*U1*	*U2*	*Frequency*[b]	*Cross-Classified*[c]
Audit Manual[d]	1	3.96[e]	3.28	3.72	3.72	n.s.	
	2	4.04	3.45	3.83	3.79	n.s.	.078, n.s., n.s.
Peer	1	2.11	2.17	2.21	2.89	.063	
	2	2.15	2.21	2.48	3.00	.032	
	3	2.85	2.40	2.66	3.07	n.s.	.001, .015, .049
Audit Manager	1	3.78	3.52	4.07	4.14	n.s.	
	2	3.78	3.61	4.38	4.36	.019	
	3	4.27	4.41	4.55	4.56	n.s.	.001, .011, .035
Team Conference	1	2.26	2.76	2.31	2.75	n.s.	
	2	2.22	2.97	2.66	2.89	.008	
	3	2.50	2.75	2.43	2.89	n.s.	.013, n.s., n.s.
Sampling Specialist	1	3.00	1.52	1.41	1.71	.008	
	2	3.07	1.62	1.55	1.93	.023	
	3	3.07	1.59	1.79	1.93	n.s.	.024, .007, n.s.

[a] Similar significance levels were obtained with firm (four levels) instead of structure (two levels) as the independent variable.

[b] The "frequency" model is a chi-square test for a difference between structured and unstructured firms at each level of uncertainty. The columns of the underlying frequency table are the five levels of the response scale (1 = highly unlikely to consult, 5 = highly likely to consult) and the rows are the two levels of structure (or four firms).

[c] The "cross-classified" model tests the main effects for uncertainty and structure and their interaction. The table values are the significance levels for uncertainty, structure, and their interaction, respectively.

[d] Subjects did not provide a response under high uncertainty (level three) for this mechanism.

[e] The tabulated numbers report subjects' mean response—by firm—on their propensity to consult each mechanism at each uncertainty level.

a structured approach did not exhibit uniformly greater consensus (in sample size judgments) than did unstructured firm auditors. Although the hypothesized relations between audit structure and consensus were not supported, the study's results are consistent with hypothesized differences between structured and unstructured firms' use of certain coordination and control mechanisms (e.g., consultation with peers or audit managers). As uncertainty increased, the propensity to use these mechanisms increased more for auditors from structured (as opposed to unstructured) firms.[20]

Given the available decision aids, it is somewhat surprising that structured firm auditors did not exhibit relatively greater consensus, as hypothesized in H1. Reconstruction of subjects' sample size decisions provided several insights. Both of the structured firms' decision aids structure sub-tasks required of the auditor (e.g., extent of internal control reliance, tolerable error). These decision aids then combine the auditor's (largely subjective) responses to these sub-tasks to provide a sample size. Detailed examination of the data suggested that disagreements regarding these sub-tasks (especially differences in assessed internal control reliability) considerably affected the decision aids' sample size recommendations, thereby preventing greater consensus between structured firms' auditors. Detailed analysis also showed that structured firm auditors selected a few common—but quite different—sample sizes.[21] Although these disagreements may be an artifact of the experimental materials, the low uncertainty treatment was a very straightforward situation. Actual audit clients would typically exhibit equal or greater ambiguity.

The two structured firms' subjects responded differently to the increase in task uncertainty. As hypothesized, firm S2 subjects' sample size dispersion increased at higher levels of uncertainty. This firm's procedures for receivables are somewhat less structured than S1's and allow for other procedures to supplement direct tests (confirmations). At the low uncertainty level, subjects apparently agreed on the use of other procedures to justify small confirmation sample sizes, but they differed on the appropriateness of relying on these other procedures at higher levels of uncertainty. In contrast to S2, the sample size dispersion for firm S1's subjects did not change significantly across uncertainty levels. As noted earlier (see fn. 17), one potential explanation is that a subset of firm S1's subjects placed no reliance on internal control under any treatment condition (presumably a reflection of their own experience auditing small clients).

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[20] These results may be interpreted in two ways. First, these mechanisms may compensate for disadvantageous aspects of audit structure (e.g., inflexibility). On the other hand, the findings may also be described in a more positive vein, as suggesting that increased audit structure reduces the need for coordination and control mechanisms in tasks of modest uncertainty.

[21] The sample size distribution for firm U2 exhibited a similar pattern. However, rather than resulting from specific calculations, the common sample sizes (e.g., 40, 60) appeared to reflect informal conventions. In contrast, firm U1's statistical samplers' responses yielded a relatively flat unimodal distribution.

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Judgment Consensus and Auditor Experience: An Examination of Organizational Relations

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ABSTRACT: Previous studies examining internal accounting control judgments have found an inconclusive association between auditor consensus and auditor experience. The present study suggests that an association between judgment consensus and situational experience may be confounded because of the tenure of an auditor with the same audit staff group and/or superior. The adaptive behavior in an organizational relation suggests that judgment consensus among subordinates should increase (i.e., become more congruent) as the subordinate has greater interaction with the audit staff group and/or superior. As support for these expectations, an experiment was conducted using auditors of a state auditor's office. The results indicate that consensus among staff auditors increased as the length of time that staff auditors had been associated with the same audit manager increased, but did not increase based on the length of time that the auditors had been with the state auditor's office.

A GROWING body of empirical research has assessed judgment consensus among auditors facing identical situations. A portion of these studies has examined the effect of experience on these judgments. In general, previous research indicates substantial consensus in the internal accounting control judgments of auditors [Ashton, 1974a, 1974b; Ashton and Kramer, 1980; Ashton and Brown, 1980; Hall et al., 1982; Gaumnitz et al., 1982; Hamilton and Wright, 1980; and Tabor, 1983], but little or no positive association with situational (task-related) experience [Ashton, 1974b; Hamilton and Wright, 1982; Hall et al., 1982; and Nanni, 1984].

Past studies have defined situational experience in terms of total audit experience. If experience is so measured, then four factors may promote an increase in consensus: (1) greater expertise gained from repeated performance of a task (situational experience); (2) the subordinates' learning of the expectations of their superior from policy statements

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and/or feedback; (3) the subordinates' learning of the norms of their work group; and (4) the mortality of subordinates who do not operationalize congruent policies. The latter three factors may have confounded the situational experience measurement used in previous studies. The objective of the present study was to isolate the effects of the first factor from the latter three organizational factors.

The study reported herein differentiates between two types of experience. *Situational* experience is defined as the duration of total audit experience. *Organizational* experience is the duration of a subordinate's experience with an audit staff group and its superior. The idea of organizational control [Tannenbaum, 1968] suggests a correlational link between consensus and organizational experience. Control within organizations is a process by which a person or a group intentionally affects what another individual will do. The function of this control is to bring about conformance with the goals of the organization. Smith and Ari [1964] have shown that the degree of control exerted by both superiors and fellow group members is related positively to the uniformity of perceptions and attitudes within an organization, i.e., consensus (see, also, Golembiewski [1962], Back [1951], and Festinger and Thibaut [1951]). The individual's desire to succeed or be accepted by a group may augment the effects of the control mechanisms. These factors suggest that organizational experience, as opposed to situational experience, will be the dominant force which increases consensus.

Subsequent sections contain: (1) a description of the auditing organization that was studied; (2) research hypotheses; (3) a description of the research method; (4) the findings and interpretations; and (5) discussion and limitations.

A FIELD STUDY

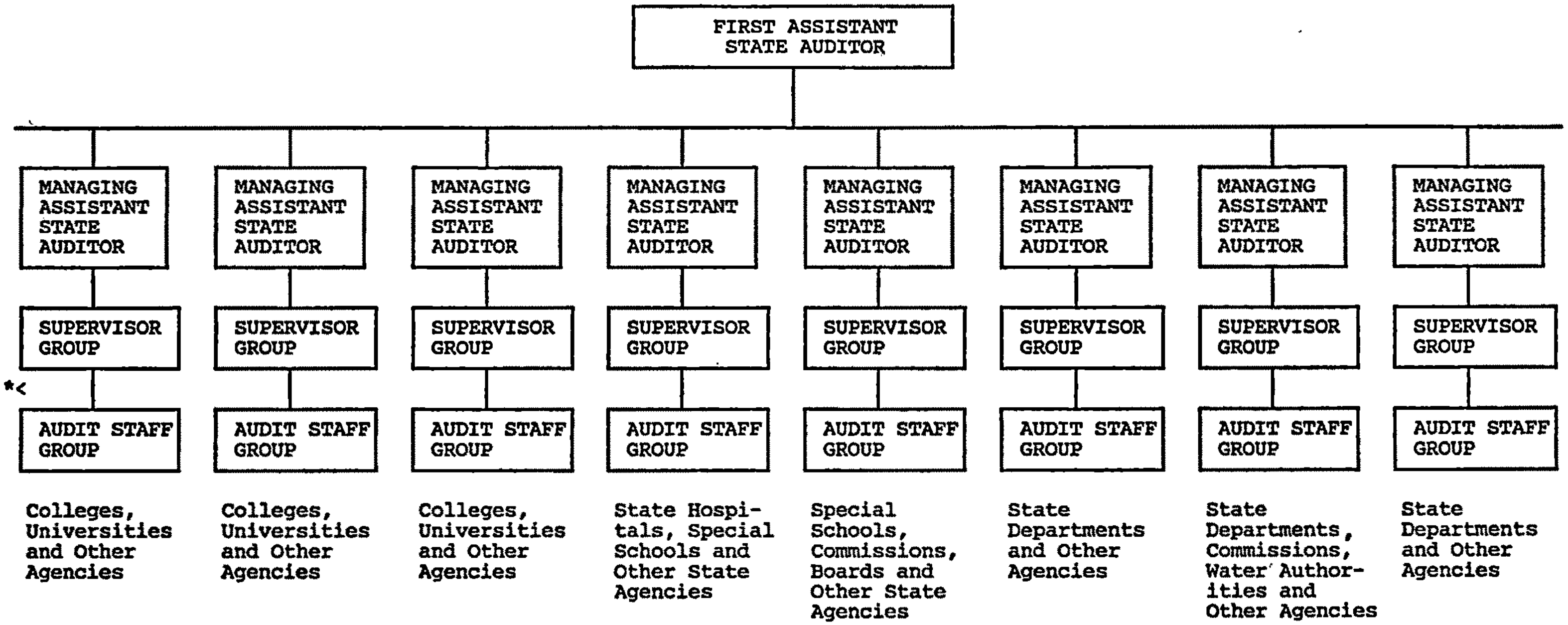
The present experiment is a field study of one auditing entity: the Audit Division of the State Auditor's Office (SAO), State of Texas. The organizational structure of the SAO, presented in Exhibit 1, consists of: (1) a First Assistant State Auditor (FASA); (2) eight Managing Assistant State Auditors (MASAs) who report directly to the FASA; (3) audit supervisors consisting of members of the audit staff who are assigned a supervisory role for specific audits; and (4) eight audit staff groups that report through the assigned supervisors to the managers.

Although the supervisory level is a separate organizational level, no one person or group of auditors is designated as a supervisor. Instead, auditors serve either as staff auditors or supervisors depending on the audit, the circumstances surrounding the audit, and the needs of the office. Because of this general lack of singularity at the supervisory level, no distinction was made between supervisors and the audit staff groups for testing purposes. Therefore, two hierarchical levels were studied: the eight MASAs and their audit staff groups consisting of both supervisors and staff auditors.

Staff auditors were categorized into two levels of experience that, according to an expert panel, clearly demarcate experience in the audit entity studied: inexperienced staff auditors having less than 18 months of service and experienced staff auditors having over 30 months of service. The participants included eight MASAs and 76 of the 134 staff auditors responsible to the MASAs. The number of staff auditors represented at three combinations of situational and organizational experience levels were as follows:

Exhibit 1

Organization Chart—Auditing Division


FIRST ASSISTANT STATE AUDITOR
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
*<
AUDIT STAFF GROUP
Colleges, Universities and Other Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
Colleges, Universities and Other Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
Colleges, Universities and Other Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
State Hospitals, Special Schools and Other State Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
Special Schools, Commissions, Boards and Other State Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
State Departments and Other Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
State Departments, Commissions, Water Authorities and Other Agencies
MANAGING ASSISTANT STATE AUDITOR
SUPERVISOR GROUP
AUDIT STAFF GROUP
State Departments and Other Agencies

* The supervisor group and audit staff group were treated as one group for testing purposes.

30 auditors with less than 18 months of service with the SAO and with their MASA (both situationally and organizationally inexperienced auditors);

16 auditors with less than 18 months of service with their present MASA, but with more than 30 months of service with the SAO (situationally experienced, but organizationally inexperienced auditors; and

30 auditors with more than 30 months of service with the SAO and with their present MASA (both situationally and organizationally experienced auditors).

To provide discernable differences on the independent variable, 32 staff auditors that had between 18 and 30 months of experience with either the SAO or the MASA were not studied. Of the remaining 26 non-participants, eight (one from each audit staff group) were randomly selected to serve on an expert panel to assist in the development of the research instrument. One subject provided unuseable responses. Seventeen staff auditors were not available for study (vacations, etc.).

On average, the staff auditors were 30 years of age and had 4.3 years of experience with the SAO. Sixty-one percent of the staff were male and ten of the staff members had previous experience with public accounting firms. Thirty-seven percent of the staff auditors were CPAs. SAO auditors participate in in-house continuing education classes, but the topic of IAC evaluation had not been covered in the four years preceding this study. Only four auditors had less than six months of experience with the SAO.

RESEARCH HYPOTHESES

Given the organizational structure of the SAO, two research hypotheses, each stated in null form, are advanced. Situational experience is defined as the amount of experience staff auditors have with the SAO. Organizational experience is defined as the amount of experience staff auditors have with their MASA. Consensus refers to consensus measured within an audit staff group and averaged across all groups. The following two null hypotheses were tested:

H1: Consensus among organizationally inexperienced staff auditors is not related positively to situational experience.

H2: Consensus among situationally experienced staff auditors is not related positively to organizational experience.

These hypotheses form the central premise of the present study that, in isolation: (1) situational experience is not positively correlated with consensus (i.e., no rejection of null hypothesis H1); and (2) organizational experience is correlated with consensus (i.e., rejection of null hypothesis H2).

A preferred investigative procedure would be to compare the two experience definitions in a full factorial design in terms of existence and non-existence. However, the amount of experience that subordinates have with their managers or work groups (organizational experience) and the amount of situational experience cannot be negatively associated and, for most entities, should be highly positively correlated. That is, the two definitions of experience coexist. This duality prevents a full factorial investigation that defines a group of auditors who are experienced with their manager but who are new with the entity. Therefore, the hypothesis concerning situational experience (H1) holds organizational experience constant at a low level, and the hypothesis concerning organizational experience (H2) holds situational experience constant at a high level.

METHOD OF ANALYSIS

The initial research package contained 32 cases. Each case consisted of six internal accounting control questions concerning the proper recording of journal vouchers (documents that support adjusting, correcting, opening, and closing entries) by state agencies. This subarea of the state agency accounting system was selected because: (1) it is considered by the SAO to be a high risk area common to all state agencies that are audited by the audit staff groups; and (2) the internal control evaluation is made routinely by, and therefore is familiar to, all participants.

The internal control questionnaire used by the SAO includes three categories of questions designed to meet the objectives of authorization, accounting, and safekeeping. Eight questions were chosen that were neither closely related nor interdependent (a condition necessary for orthogonality), but were representative of the three objectives. The First Assistant State Auditor (FASA) assisted in the decision to delete two of the questions based on his belief that the questions would not be crucial to the evaluation process. Independent evaluation by members of the expert panel confirmed the importance of the remaining six questions.

The questions were pre-answered "yes" or "no," and each "no" answer always indicated a weakness in internal control. The sequence of "yes" and "no" answers to the six questions were consistent with a one-half fractional replication of 2^6 factorial design [Cochran and Cox, 1957]. A one-half replication consists of all treatment combinations that contain either even-number combinations (6-0, 0-6, 4-2, 2-4) or odd-number combinations (5-1, 1-5, 3-3). Consistent with Hoffman et al. [1968] and Ashton [1974a, 1974b], even-number combinations were used, which resulted in one case with all "yes" answers, one case with all "no" answers, 15 cases with combinations of four "yes" and two "no" answers, and 15 cases with combinations of two "yes" and four "no" answers.[1]

In addition to the 32 cases, two practice cases using a combination of three "yes" and three "no" answers were added as the first two cases, and four repeat cases, selected randomly, were placed at the end of the set. The reliability of the subjects' responses was measured by correlating responses to the four experimental and repeat cases for each auditor and then averaging the correlations among all auditor participants. The mean reliability was relatively high at .77.

The participants rated the internal control effectiveness indicated by each case on a seven-point polar scale with end points of "extremely weak" and "adequate to strong." An example case is presented in Exhibit 2. Consensus was measured by correlating the 32-case response set between auditor pairs and then averaging (via a Fisher's Z).

RESULTS AND INTERPRETATIONS

The average correlation coefficient among all participating staff auditors

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[1] A pilot test using students was conducted with the cases randomly ordered. Senior auditing students indicated a marked change in their response pattern following the completion of the all "yes" and all "no" cases. The pilot subjects appeared to rescale their judgments upon encountering these extreme cases. The placement of these two cases at the beginning of the set of experimental cases was believed to provide the subjects with the opportunity to establish the extreme values to use in their evaluation of the remaining randomly ordered cases.

EXHIBIT 2
EXAMPLE CASE

	Yes	*No*
1. Are completed journal vouchers reviewed and approved by responsible supervisory personnel?	X	
2. Are journal vouchers prepared by a technically knowledgeable employee?	X	
3. Is adequate documentation filed with each journal voucher?		X
4. Is the reason for each entry clearly and adequately explained on the face of the journal voucher or are unique identifying number or source codes used to designate the type of entry being made?	X	
5. Is the preparation of journal vouchers and entry into the general ledger limited to certain designated personnel?		X
6. Are employees who prepare journal vouchers encouraged to take vacations and is their work performed by someone else in their absence?	X	

Please circle the number that best reflects your evaluation of internal control.

1	2	3	4	5	6	7
extremely weak						adequate to strong

was .730, which is similar to Ashton [1974a, 1974b] and subsequent studies (see Ashton [1983]). If computed without consideration of audit staff group membership, the level of consensus increased from .707 to .754 as situational experience increased. However, the level of consensus also increased from .716 to .766 as organizational experience increased. Therefore, the apparent presence of a positive association between consensus and situational experience may be spurious because of the potential confounding attributable to organizational experience.

The testing of hypotheses employed a large-sample parametric test of means [McClave and Dietrich, 1985] with test statistic denoted by Z. Statistical tests were adjusted by a finite population correction factor [Scheaffer et al., 1979] to infer only to the population of auditors in the SAO.[2]

Consensus measurements for the three combinations of situational and organizational experience are reported in Table 1. The purpose of these consensus measurements was to separate the effects of situational and organizational experience. The connecting arrows spanning the consensus measurements represent the comparisons that relate to each research hypothesis.

Hypothesis H1. If a positive association exists between consensus and situational experience, then consensus should increase as situational experience increases and organizational experience remains constant at an inexperienced level. A small increase was found, from .697 for inexperienced staff auditors to .704 for staff auditors who were experienced on the job but new with their

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[2] The finite population adjustment was $(N-n)/N$, where N is the maximum number of pairwise comparisons for the population of staff auditors in the relevant group and n is the number of pairwise comparisons related to the sample.

TABLE 1

CONSENSUS MEASUREMENTS[1]

	Number of Months				
Situational Experience	<18		>30		>30
Organizational Experience	<18		<18		>30
Average Correlation		H1		H2	
Among Audit Staff	.697	←——→	.704	←——→	.775
Members:	(47)	n.s.	(32)	$p<.001$	(79)

[1] The number of pairwise correlations used in the computation of the average correlation (consensus) is presented parenthetically. The solid connecting lines represent comparisons to test the research hypotheses.

MASA, but the increase was not statistically significant ($Z=.74$). Therefore, situational experience did not seem to explain the convergence of consensus existing within the SAO.

Hypothesis H2. If a positive association exists between consensus and organizational experience, then consensus should increase as auditors spend a greater amount of time within the group and with their MASA. A significant increase in consensus, from .704 to .775, was associated with an increase in organizational experience among situationally experienced staff auditors ($Z=6.99$; $p<.001$). Therefore, null hypothesis H2 is rejected in support of an organizational interpretation of experience. This finding suggests that either the group or the MASA may have been instrumental in shifting an inexperienced staff auditor's judgments toward congruence with the judgments of experienced auditors.

To lend further support to these findings, pairwise correlation measurements were tabulated into intervals of equal width to form a representation of the frequency distribution. The frequency distribution for each of the three experience groups is presented in Table 2. A Kolmogorov-Smirnov two-sample test [Conover, 1971, pp. 309–314], was used to test for differences in the distribution functions. The distribution function for the experienced auditor group differed significantly from both the inexperienced auditor group ($t=2.11$, $p<.01$) and the situationally experienced, organizationally inexperienced auditor group ($t=1.37$, $p<.05$). This finding is consistent with a positive association between organizational experience and consensus which adds support to the rejection of hypothesis H2.

Conversely, a statistically significant difference was not detected between the situationally inexperienced auditor group and the situationally experienced, organizationally inexperienced auditor group ($t=1.16$). This finding corroborates the previous finding of an absence of a relation between situational experience and consensus, i.e., a failure to reject hypothesis H1.

DISCUSSION AND LIMITATIONS

Previous studies that examined the relation between situational experience and consensus have reported contradictory findings [Ashton, 1983]. The present research attempted to explain these contradictions by suggesting that they may be a direct result of defining experience as time on the job. An alternative definition of experience was proposed that relates to the length of time that the

TABLE 2

FREQUENCY DISTRIBUTION OF PAIRWISE CORRELATIONS[1]

	Number of Months		
Situational Experience	<18	>30	>30
Organizational Experience	<18	<18	>30
Range of Correlation Measurements			
.88–.93		3.1	15.2
.82–.87	6.4	21.8	16.5
.76–.81	19.1	25.0	25.3
.70–.75	29.8	12.5	30.4
.64–.69	21.3	12.5	11.4
.58–.63	14.9	6.3	1.2
.52–.57	6.4	6.3	
.46–.51	2.1	9.4	
.40–.45		3.1	

H1 H2

$t=1.16$ n.s. $t=1.37, p<.05$

$t=2.11, p<.01$

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[1] Table values represent the percentage of correlation measurements that fall within a given range and the total for each experience group equals 100 percent. The statistical test was a Kolmogorov-Smirnov two-sample test.

task was performed within the same work group, under the supervision of the same superior.

The present research lends support for this alternative interpretation of experience. No increase in consensus was found among staff auditors within the same audit staff group that could be attributed to job tenure. Instead, consensus was found to increase with the auditors' tenure with an audit staff group under the supervision of the same manager.

A key limitation of the present study was the inability to control experimentally for auditors that left the SAO. For example, auditors who have been with the same MASA may be favored employees, whereas others not in favor may have left the organization. Consequently, the survivors may have greater consensus because of their survival, not because of judgment convergence, *per se*. Another limitation is the inability to design the experiment to include a group of new staff auditors who have a long-term relationship with a manager. This group, of course, cannot exist. This limitation of design prevents an analysis of interaction that would be possible with a full factorial design. A third limitation relates to poorly defined organizational relations within the SAO that are created from the sharing of the supervisory role among the more experienced staff auditors. This prevented an investigation as to whether the experience-consensus relationships that were found were attributable to group membership or to the control exerted by the superior.

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Rates of Return and Cash Flow Profiles: An Extension

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ABSTRACT: The cash recovery rate (CRR) has recently received attention as a basis for obtaining a measure of the economic rate of profitability of a firm as measured by its internal rate of return (IRR). This paper extends prior work by developing a model of the CRR-IRR relation which incorporates a commonly noted concave cash flow pattern for the firm's projects. The model forms the basis for converting an estimate of the firm's CRR into an estimate of its IRR. Empirical evidence is provided that the IRR estimates that are based upon the concave cash flow pattern are strongly associated with the IRR estimates based on the simpler cash flow profiles assumed in earlier work.

THE deficiencies associated with utilizing accounting rates of return to gage a firm's economic profitability are well documented [Benston, 1985; Fisher and McGowan, 1983; Fisher, 1984; Gordon, 1974; Harcourt, 1965; Kay, 1976; Livingstone and Salamon, 1970; Solomon, 1966, 1970; Stark, 1982; Stauffer, 1971; and Wright, 1978]. As a result, an alternative measure based on a cash recovery rate has been proposed [Brief, 1985; Ijiri, 1978, 1979, 1980; Kaplan, 1982; Salamon, 1982, 1985; and Stark, 1987]. In this regard, Salamon [1982, p. 302] argued that "we are closer than ever before to having an empirical measure of the profit performances of firms which is directly linked to a discounted cash-flow rate of return." The basis for this optimism is the ability to convert cash recovery rate (CRR) estimates into internal rate of return (IRR) estimates. However, one important problem associated with the conversion of CRRs into IRR estimates is the need to make an assumption about the cash flow profile of the firm's typical (or composite) project.

The first purpose of this Note is to extend the previous analytical work on cash recovery rates by incorporating concave cash flow profiles into a CRR model. A small sample survey by the

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authors suggests that such profiles are more prevalent in practice than the profiles assumed in previous research. The second purpose of this Note is to investigate whether this more realistic cash flow profile produces profitability estimates which are similar to the estimates produced by the more simplistic profiles assumed in prior work. The results presented here suggest that the more realistic profiles produce IRR estimates that are highly associated with the IRR estimates contained in prior research. If this high degree of association among alternative CRR-based estimates of IRR were to prevail in larger samples, it would suggest that the prior estimates of IRR may have been of reasonable usefulness in cross-sectional work even though the estimates were based on unrealistic cash flow profile assumptions.[1]

PRIOR RESEARCH

The cash recovery rate is defined as the cash recovery for a period divided by the gross investment for the period [Ijiri, 1978, p. 388].[2] If the firm reinvests all of its cash recoveries, Ijiri [1979] shows that the reciprocal of the capital recovery rate is the present value of an annuity of 1 for *n* years at a given discount or interest rate, *r*. Therefore, by setting a firm's average recovery rate equal to the reciprocal of the present value of an annuity of 1, and solving for *r*, an estimate of the firm's IRR is obtained. However, under the assumption of 100 percent reinvestment of cash flows, Livingstone and Salamon [1970] and Stauffer [1971], among others, have shown that a firm's growth rate approaches its IRR and in turn the firm's accounting rate of return (ARR) converges toward the IRR. Thus, under the 100 percent reinvestment assumption, the ARR is also a good proxy for the IRR.

Recognizing that Ijiri's results are premised on assumptions which, if valid, would qualify the ARR as a good proxy for the IRR and, thus, negate the need to compute a CRR, Salamon [1982] set out to extend Ijiri's work on cash recovery rates. More specifically, Salamon examined the link between a firm's CRR and its IRR when the firm does not reinvest all of its cash flows and under conditions of inflation.

Salamon [1982, p. 297] demonstrated that when reinvestment is not 100 percent the CRR converges to a constant which is related to r', the internal rate of return, as defined below:

$$CRR=\left[\frac{(1-pg)p^n g^n}{1-p^n g^n}\right]\left[\frac{g^n-b^n}{g^n(g-b)}\right]\times\left[\frac{r^n(r-b)}{r^n-b^n}\right] \qquad (1)$$

where

$p=1+p'$, and
p' = constant inflation rate in all prices,
$g=1+g'$, and
g' = constant rate of growth in gross investment,
$r=1+r'$, and
r' = internal rate of return of firm projects,

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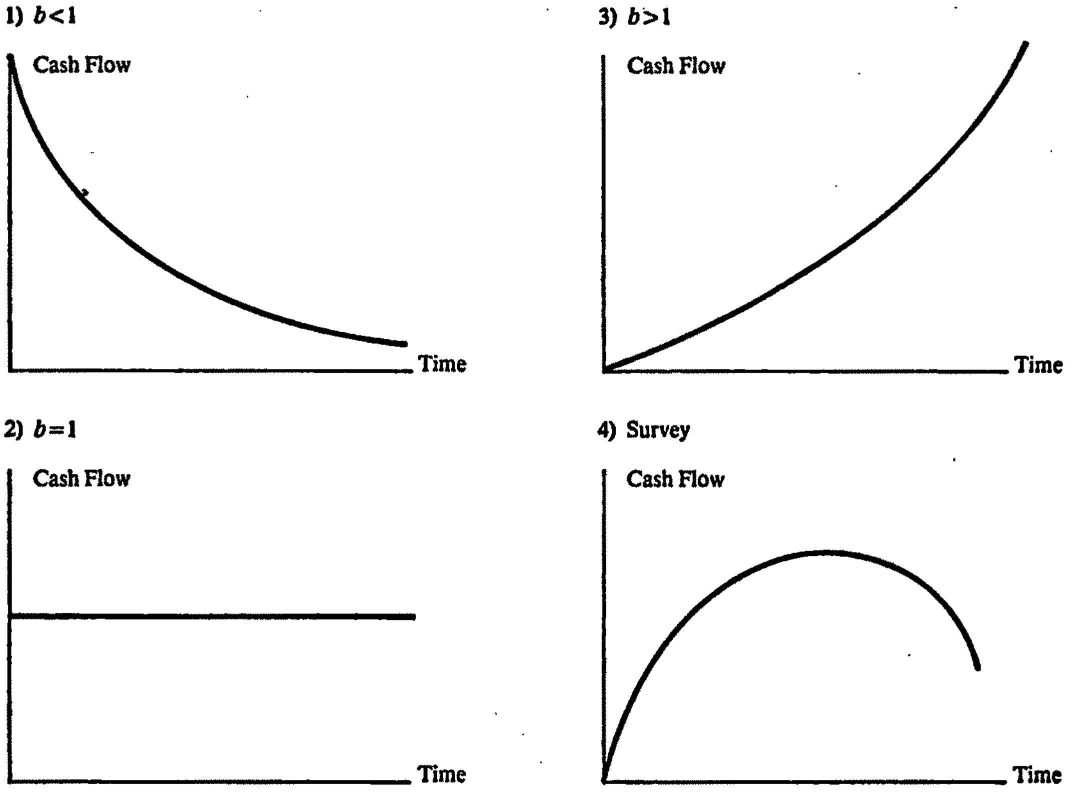
[1] This statement relies on the assumption that there is no variation in cash profiles across firms. At present, the possibility of cross-sectional variation in cash flow profiles and our inability to estimate firm specific profiles is one of the most difficult obstacles in the way of obtaining unconditional estimates of firm IRRs.

[2] Ijiri [1978, pp. 345–347; 1980, pp. 55–56] suggested the following procedures for estimating cash recoveries and investments from traditional financial statements. Cash recoveries may be approximated by the sum of funds from operations, proceeds from disposals of long term assets, decrease in total current assets (if any) and interest expense. Gross investment is calculated as total assets plus accumulated depreciation (i.e., gross assets) averaged over the beginning and ending balances for the year. For comparability to Ijiri and Salamon's work, our empirical study will use the same definition of the CRR.

FIGURE 1

BASIC CASH FLOW TIME PROFILES FOR VARIOUS VALUES OF SALAMON'S *b* AND THE SURVEY



b = project cash flow parameter. If annual project cash inflows are $C_1 \ldots, C_n$ then b is such that $C_i = b^{i-1}C_1$, for $i=1$ to n,

n = the life of firm projects.

If p, g, b, and n are known (or assumed) the above equation can be solved for a conditional internal rate of return.

Salamon [1982] estimated p, g, and n, assumed some values for b (.8 and 1), and then used equation (1) to produce six different IRR estimates for a convenient sample of firms first investigated by Ijiri [1980]. Salamon found a high degree of association among sets of the IRR estimates and then argued that the ranking of firms by these estimates of their IRRs is largely unaffected by the cash flow patterns of the firms' composite projects, given that the composite projects of the firms being ranked are assumed to have similar cash flow patterns (i.e., b in the above equation is the same across firms).

MODEL EXTENSION

In Salamon's model the cash flow pattern parameter, b, is fairly simplistic. It can reflect only the profiles in panels 1, 2, and 3 of Figure 1.[3] For $b<1$, project cash flows are declining at a constant rate. For $b=1$, the project cash flows are uniform. For $b>1$, the project cash flows are increasing at a constant rate. However, as part of a survey of firms we found that the cash flow profile illustrated in panel 4 of Figure 1 was more prevalent than any of the other profiles. In particular, 16 of 23 firms chose the cash flow profile depicted in panel 4 as the one representing the cash profile of their composite projects.[4]

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[3] Various versions of the four cash flow profiles illustrated in Figure 1 have been noted throughout the literature (e.g., see Harcourt [1965, p. 68]).

The survey results suggest that it may be fruitful to reformulate Salamon's model to incorporate the more realistic cash flow profile shown in panel 4 of Figure 1 and examine its effect on IRR estimates. To incorporate the concave cash flow pattern, Salamon's "b" is replaced with a new cash flow pattern parameter, "B", such that: $C_i=(iB^{i-1})C_1$, for $i=1,2,\ldots,n$, and $.50<B<1$. (The range limits on B are necessary to insure the inverted U shape: For $B<.5$ the cash flow profile is always decreasing and for $B>1$ the cash flow profile is always increasing.) Hence, the exact nature of the cash flow pattern will be determined by B, instead of b, as well as the other parameters in Salamon's model (i.e., p, g, and n). The proposed cash flow profile is such that it increases over the early years of the project's life, reaches a maximum level, and then decreases. The year in which the project has its maximum cash flow depends upon the parameter B.[5] As indicated in equation (2) below, the introduction of this concave cash flow profile preserves the relative simplicity of the multiplicative relation between CRR and IRR:

$$CRR=\left[\frac{(1-pg)p^n g^n}{(1-p^n g^n)}\right]\left[\frac{r-B}{g-B}\right]\times \left[\frac{\dfrac{g^n-B^n}{g^{n-1}(g-B)}-\dfrac{nB^n}{g^n}}{\dfrac{r^n-B^n}{r^{n-1}(r-B)}-\dfrac{nB^n}{r^n}}\right] \tag{2}$$

EMPIRICAL EVIDENCE

We now consider whether the IRR estimates derived from equation (2) will be similar to or different from the estimates derived from equation (1). In order to address this issue, and to provide comparability to prior work, IRR estimates are computed based on equation (2) for the same 20 firm sample examined by Ijiri [1980] and Salamon [1982]. Six new IRR estimates are produced for this analysis. The estimates are created by choosing the new cash flow parameter, B, in a manner so that the maximum cash flow for the project would occur in its k^{th} year where k is set equal to $1/3n$, $1/2n$, and $2/3n$. Following Salamon [1982], each of these assumptions about cash flow profile is combined with a different assumption about project life—one set of estimates assumes a 20 year project life while the other set of estimates is based upon an estimated project life. This approach leads to cases in which B is constant across firms and to cases where B varies across firms.

[4] A complete description of this survey and its results are available from the authors.

[5] Given the proposed cash flow function $C_i=(iB^{i-1})C_1$, the point where C_i is at a maximum is equivalent to maximizing (iB^{i-1}) with respect to i. Thus, if we let $f(i)=iB^{i-1}$, our objective is to find i such that:

$$\text{Max } f(i)=iB^{i-1},\ i=1,2,\ldots,n \text{ and } .5<B<1$$

To determine the time period where the cash flow pattern is at its maximum, take the first derivative and set it equal to zero:

$$f'(i)=\frac{d(iB^{i-1})}{d\,i}=B^{i-1}+iB^{i-1}\ell nB=0$$

$$=B^{i-1}(1+i\ell nB)=0$$

since $B^{i-1}>0$

$$1+i\ell nB=0$$

Hence, $i=\dfrac{-1}{\ell nB}$, subject to $\dfrac{-1}{\ell nB}$

Note that if B is the same for two firms then the two firms will have composite projects which reach their maximum cash flow point in the same year of the project's life even if the projects have different useful lives.

Panel A of Table 1 shows the six new IRR estimates developed from equation (2) while panel B of Table 1 summarizes the correlation coefficients among the various IRR estimates from our model (IRR(*j*), $j=7,8,\ldots,12$) and those of Salamon's [1982] model (IRR(*j*), $j=1, 2,\ldots,6$). The most striking feature of panel B of Table 1 is that the IRR estimates derived from the revised model are highly associated with those derived from Salamon's [1982] model given comparable assumptions about project life. For example, IRR(*j*), $j=1, 2, 3$ and $j=7, 8, 9$ are all based on a useful project life assumption of $n=20$ years and the *lowest* observed correlation among these estimates is .93. Additionally, IRR(*j*), $j=4, 5, 6$ and $j=10, 11, 12$ are all based on firm specific estimates of useful life. The lowest observed correlation among these IRR estimates is .858. The correlations between the IRR estimates based on an n equal to 20 years and the IRR estimates based on a firm specific n are consistently lower. Thus, the results here are consistent with those of Salamon [1982, pp. 299–301] in that estimates of, or assumptions about, the useful life of firm projects are an important influence on the nature of the resulting IRR estimates. It is also important to note that panel B of Table 1 reveals about the same degree of correlation between the IRR estimates developed here (i.e., IRR(*j*), $j=7,8,\ldots,12$) and the firm's ARR as was found by Salamon [1982]. In particular, most of the correlation coefficients fall into the range of .70 to .85. Thus, the empirical assessment of the degree of measurement error contained in the ARR is not reduced when the more realistic cash flow profile of this Note are incorporated into the IRR estimation procedure.

CONCLUSION

This Note has extended Salamon's [1982] CRR model to include a more realistic cash flow profile for a firm's composite project. The high degree of association among these IRR estimates suggests that the ranking of firms based on the IRR estimate from the revised model would be consistent with the ranking of firms based on the IRR estimates from Salamon's model. Hence, the CRR-based estimates of firm profitability appear to be fairly robust with respect to the choice of composite project cash flow profiles among the four profiles shown in Figure 1 given the assumption that the same profile shape is appropriate for all firms in the sample. It appears that further progress in obtaining improved estimates of a firm's IRR will require empirical work on the actual cash flow profiles associated with the composite projects of firms. Until this additional evidence is provided, we are forced to make assumptions about the cash flow profiles of firm projects. In the meantime, this Note provides some evidence that suggests that the distribution of IRR estimates within a sample are not sensitive to differing assumptions about the shape of these profiles *if all* firms in the sample can be assumed to have profiles of a similar shape.

TABLE 1

ESTIMATED RATES OF RETURN AND PEARSON CORRELATION COEFFICIENTS UNDER MODIFIED MODEL

(*A*) *Estimated Rates of Return*

	USEFUL LIFE=20 Years			*USEFUL LIFE=ESTIMATED LIFE*		
	$i=(1/3)n$ $B=.867$ *IRR(7)*	$i=(1/2)n$ $B=.905$ *IRR(8)*	$i=(2/3)n$ $B=.926$ *IRR(9)*	$i=(1/3)n$ *IRR(10)*	$i=(1/2)n$ *IRR(11)*	$i=(2/3)n$ *IRR(12)*
Alcoa	1.33%	1.40%	1.40%	1.40%	1.40%	1.40%
American Brands	3.93%	3.80%	3.80%	2.30%	2.40%	2.40%
American Can	0.80%	0.80%	0.80%	0.40%	0.50%	0.60%
Bethlehem Steel	−0.79%	−0.70%	−0.60%	0.40%	0.40%	0.40%
Chrysler	0.66%	0.30%	0.30%	2.10%	2.30%	2.40%
DuPont	4.62%	4.40%	4.30%	2.10%	2.20%	2.20%
Esmark	4.57%	4.30%	4.10%	4.20%	3.90%	3.80%
GE	4.14%	4.20%	4.30%	1.10%	1.60%	1.80%
GF	4.76%	4.70%	4.70%	4.90%	4.90%	4.90%
GM	7.76%	7.20%	6.90%	7.80%	7.10%	6.80%
Goodyear	1.08%	1.40%	1.50%	0.60%	1.00%	1.20%
Gulf	4.56%	4.30%	4.20%	4.30%	4.00%	4.00%
IBM	12.78%	12.40%	12.20%	7.10%	7.50%	7.60%
International Harvester	1.04%	1.00%	1.10%	1.80%	1.70%	1.70%
International Paper	4.84%	4.70%	4.60%	5.20%	4.90%	4.80%
RCA	7.32%	7.10%	7.00%	−0.80%	0.10%	0.20%
Texaco	3.53%	3.60%	3.70%	4.30%	4.40%	4.40%
United Technology	2.57%	3.00%	3.20%	0.50%	1.20%	1.50%
US Steel	−1.84%	−1.70%	−1.60%	0.50%	0.40%	0.40%
Westinghouse	−0.25%	0.10%	0.20%	−0.60%	0.20%	0.00%
Mean	3.37%	3.32%	3.31%	2.48%	2.61%	2.63%

TABLE 1—*Continued*

(B) Pearson Correlation Coefficients

	IRR(1)	*IRR(2)*	*IRR(3)*	*IRR(4)*	*IRR(5)*	*IRR(6)*	*ARR*	*IRR(7)*	*IRR(8)*	*IRR(9)*	*IRR(10)*	*IRR(11)*	*IRR(12)*
IRR(1)	1.000												
IRR(2)	0.998	1.000											
IRR(3)	0.963	0.949	1.000										
IRR(4)	0.717	0.695	0.776	1.000									
IRR(5)	0.741	0.725	0.767	0.996	1.000								
IRR(6)	0.583	0.543	0.708	0.942	0.907	1.000							
ARR	0.837	0.836	0.809	0.715	0.735	0.587	1.000						
IRR(7)	0.999	0.999	0.953	0.702	0.731	0.554	0.835	1.000					
IRR(8)	0.995	0.999	0.939	0.681	0.713	0.525	0.844	0.998	1.000				
IRR(9)	0.992	0.997	0.930	0.671	0.704	0.509	0.845	0.996	0.999	1.000			
IRR(10)	0.703	0.682	0.742	0.998	0.997	0.927	0.703	0.689	0.669	0.658	1.000		
IRR(11)	0.763	0.750	0.771	0.987	0.997	0.877	0.752	0.754	0.739	0.732	0.990	1.000	
IRR(12)	0.773	0.762	0.770	0.980	0.994	0.858	0.759	0.766	0.753	0.746	0.985	0.998	1.000

Note: The estimates IRR(j), (j=1, … ,6), are obtained by the use of equation (1) and are taken from Salamon [1982, Table 1, p. 297]. IRR(j), j=1,2,3, assume a project life of 20 years while IRR(j), j=4,5,6 are based upon firm specific estimates of useful life. IRR(1) and IRR(4) assumed that $g'=r'$; IRR(2) and IRR(5) assume that $b=1$; and IRR(3) and IRR(6) assume that $b=0.8$.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

Accounting for Hybrid Securities: The Case of Adjustable Rate Convertible Notes

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ABSTRACT: A number of new types of financial instruments have appeared in recent years, many of which have characteristics of both debt and equity. Accounting standards, however, have not specified the treatment of these hybrid securities for financial reporting purposes. As a result, companies have considerable latitude in how the instruments are reported, and some instruments have been designed in part for their financial reporting implications. One such instrument is the adjustable rate convertible note (ARCN). The treatment of ARCNs for both financial and tax reporting is discussed and an approach to accounting for ARCNs and other hybrid financial instruments is proposed which focuses on the substance of the instruments.

A NUMBER of new financial instruments have come into existence in recent years as financial planners and security underwriters have become increasingly creative in their attempts to assist companies in raising capital. Sanborn and Atchison [1985] describe several of these new securities and indicate methods that have been used in practice to account for them. Although the FASB is studying the matter, current pronouncements are outdated and do not adequately cope with the unusual features included in the newer securities. Not surprisingly, there is a lack of uniformity in the financial reporting procedures for the new securities.

One of these new securities, the adjustable rate convertible note (ARCN), provides an interesting example of the types of issues that arise in accounting for hybrid securities. The treatment of ARCNs provides valuable insight as to the factors that often influence the choice of accounting methods by companies when authoritative guidance is not available.

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The sections that follow include discussions of: (1) the nature of adjustable rate convertible notes and the reasons behind their issuance; (2) the accounting treatments that have been used in practice; (3) a suggested method of accounting for ARCNs that is also applicable to other types of financial instruments; (4) the tax treatment of ARCNs; and (5) summary points relative to the issues discussed throughout the paper.

THE NATURE OF ARCNs

ARCNs, like many other liabilities, are financial instruments in which the issuer promises to pay a sum of money to the note's holder at maturity and to make periodic cash payments to the holder while the note is outstanding. The original type of ARCNs issued in 1982 and 1983, however, contained several features not typically associated with either straight debt or traditional convertible bonds:

1. Periodic cash payments were set at issuance to provide a current yield above the dividend yield on the issuing company's common stock.
2. Periodic payment was to be adjusted periodically for changes in the company's common dividends so that the periodic payment on the notes would always exceed, at least slightly, the dividends on the stock into which the notes were convertible.[1]
3. Maturity values were significantly lower than their face amounts.
4. ARCNs were convertible into common stock at a fixed conversion rate.
5. ARCNs were convertible into shares having a total market value at the time the note was issued equal to the note's face amount.

Because the ratio at which each note was convertible into stock was set so that the value of the stock at issuance of the note was equal to the note's face amount, and because the note's redemption value was significantly below its face amount, the value of the notes derived primarily from the value of the stock. As a consequence, market prices for ARCNs generally fluctuated with the price of the stock.[2]

These original ARCNs are preferable to stock as an investment because they share in the gains of the stock, restrict downside risk, and carry an interest yield slightly in excess of the dividend yield on the stock. At maturity, however, conversion to the stock normally becomes preferable because of the sharply lower maturity value of the note.

ARCNs provide a good illustration of the way in which some publicly-held corporations work toward maximizing allowable tax deductions and minimizing the amount of balance sheet debt reported to financial statement users. ARCNs were originally designed so that the issuer could raise capital in the amount of the face value of the note but would record debt at a much lower amount. To be attractive to issuers, the reporting features had to be coupled with the deductibility of the periodic payments as interest for tax purposes. A further advantage was that maturity of the notes would not normally require a cash outlay by the issuer because the notes would be converted into common stock.

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[1] Increases in the periodic payments to maintain a differential over dividends could later be rescinded if dividends decreased. Periodic payments could not be reduced below the initial amount set at issuance.

[2] The ARCNs actually issued seldom were traded in the market. Their prices generally did increase with the stock prices as evidenced by the prices reported for the infrequent trades. There is a considerable body of literature supporting the relation between convertible debt and the underlying stock. For example, see Brennan and Schwartz [1977].

Four major companies issued ARCNs during 1982 and 1983: Borg-Warner Corp., Mapco, Inc., Hercules, Inc., and NICOR, Inc. The characteristics of these issues are indicated in Table 1.

Each issue was sold at its face amount and had a maturity value equal to either 50 or 55 percent of its face amount. All issues were callable at maturity value, and interest was to be paid quarterly. All issues provided for quarterly adjustments to the interest payments when needed to maintain a specified interval (see col. 6, Table 1) above the dividend payments on the common shares into which the notes were convertible. In addition, the terms of Borg-Warner and Hercules specified noncontingent increases in the base amount of the payments, Borg-Warner at the beginning of the fifth year and Hercules every five years.[3] As reported in column 7 of Table 1, the terms of three of the issues also contained limits on the amount of interest that could be paid per $1,000 note.

Subsequent to these initial issuances of ARCNs, the Internal Revenue Service issued Revenue Ruling 83-98 holding that ARCNs constituted an equity interest in the issuer and that the periodic payments were not deductible for tax purposes as interest. There have been no additional issuances of this type of ARCN since the first four, and three of those issues have been called, with the call forcing conversion.[4]

While the IRS may have precluded, at least temporarily, the further issuance of this type of ARCN, the matter bears closer examination for several reasons. First, one of the original issues of ARCNs (Hercules) is still outstanding, and the company contends that the tax treatment is not yet settled in spite of the Internal Revenue Service ruling. If this case is settled in favor of the company, a resurgence of this type of ARCN would likely occur. Second, while more recent issuances of ARCNs differ from the original notes in several important respects, some of the same types of issues regarding the distinction between debt and equity arise. Further, questions concerning the distinction between debt and equity also arise with numerous other hybrid financial instruments that have been issued in the past several years. The creation of novel financial instruments appears to be accelerating and yet no new authoritative accounting statements have dealt with the new instruments. Finally, the matter of ARCNs is interesting from the viewpoint of examining the process of selecting financial reporting practices and creating a financial instrument, at least in part, for its expected financial reporting characteristics.

FINANCIAL REPORTING FOR ARCNs

Although there are a number of possible accounting treatments for ARCNs, only two have been used in practice. One method, used by three of the original four companies having issued ARCNs, is to record the notes' redemption value as debt, the balance of the issue proceeds as equity, and the periodic payments as interest. A second method is to record the debt at the present value of both the periodic payments and the notes' redemption value, and the balance of the issue amount as equity.

Borg-Warner, Hercules, and Mapco followed the first approach. Borg-

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[3] The annual base payments for Borg-Warner were scheduled to change from $49.48 to $68.44. The specified annual base payments for Hercules were $47.96, $64.72, $82.08, and $109.36.

[4] More recent issues of ARCNs are different from the original type in several important respects and will be discussed more fully in a later section.

TABLE 1

CHARACTERISTICS OF ADJUSTABLE RATE CONVERTIBLE NOTES ISSUED

	Face Amount (000) (1)	*Maturity Value Per $1000 (2)*	*Term (Years) (3)*	*Initial Annual Payment Per $1000 (4)*	*Dividend Per Share (Year of ARCN Issuance) (5)*	*Minimum Interval Above Dividend (Per Share) (6)*	*Maximum Annual Payment Per $1000 (7)*	*Conversion Ratio (8)*	*Stock Price at ARCN Issue (9)*
Borg-Warner Corp.	$100,000	$550	20	$ 49.48	$ .37	$.07	$200	26.32	$38.00
Hercules, Inc.	80,000	550	25	47.96	1.38	.0625	240	29.963	33.375
Mapco, Inc.	50,000	550	20	90.08	1.40	.0625	200	43.95	22.75
NICOR, Inc.	45,400	500	25	119.46	2.96	.075	none	36.2	27.625

Sources: Company financial statements
Company personnel
Wall Street Journal

Warner, for example, recorded the issuance of its notes as follows:

Cash	100,000,000	
Notes Payable		55,000,000
Contributed Capital		45,000,000

Justification for this treatment can be found in APB Opinion No. 14, "Accounting for Convertible Debt and Debt Issued with Stock Purchase Warrants" [1969, par. 18], which states ". . . when convertible debt is issued at a substantial premium, there is a presumption that such premium represents paid-in capital." By setting the maturity value well below the issue price of the notes, the companies created "substantial premiums" which they assigned to paid-in capital.[5]

NICOR followed the second approach of recording the debt at the present value of both the periodic payments and the redemption value of the notes:

Cash	45,400,000	
Notes Payable		22,700,000
Premium on Notes Payable		11,350,000
Contributed Capital		11,350,000

The present value of the future payments was determined by discounting the notes' maturity value and the minimum periodic payments to be made to maturity. The discount rate used was approximately 15.75 percent, which was the rate that the underwriters estimated would have been required for the company to issue nonconvertible debt at par.[6] The notes were recorded at their redemption value ($22,700,000), and a premium was recorded for the difference between the present value of the future payments and the notes' redemption value. The remainder of the proceeds from issue over the portion recorded as debt was recorded as contributed capital.[7]

Table 2 compares the two methods found in practice by showing illustrative journal entries at time of issuance using the notes issued by NICOR. In addition, the table includes a third set of entries based on a proposed approach discussed later in the paper. Table 2 also provides summary entries to record the periodic payments in each of the first two years. NICOR's 25-year notes were issued for $45,400,000, had a maturity value of $22,700,000, and required base annual payments of $5,423,484 ($119.46 per $1,000 note on 45,400 notes).

Debt Equal to Redemption Value of Notes

If the notes' stated redemption value is viewed as the amount of the issuer's debt, as it was for three of the four companies, entry (1a) in Table 2 is used to record the notes' issuance. A liability is recorded for the notes' maturity value and the remainder of the proceeds is attributed to equity. The subsequent annual payments of $5,423,484 each are considered to be interest by the issuer, as illustrated by entries (1b) and (1c).[8] If the amount of the periodic payment increases, the full amount is recorded each period as interest expense.

One difficulty associated with this approach is that the effective interest rate based on the redemption value, which is the amount recorded as debt, might

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[5] Sanborn and Atchison [1985, p. 168], as well as personnel of the companies involved, cite APB Opinion No. 14 as justification for this treatment.

[6] The underwriters' estimate is from NICOR personnel. The numbers used by NICOR in its actual journal entry were rounded, leading to an implicit interest rate of approximately 15.7897 percent.

[7] Recording debt equal to the present value of all future periodic and terminal payments is consistent with the treatment normally accorded straight debt. It is in conformity with APB Opinion No. 21, "Interest on Receivables and Payables" if ARCNs are assumed to represent obligations for future periodic and terminal payments.

[8] For purposes of illustration, periodic payments are assumed to be made at the end of each year rather than quarterly.

TABLE 2

ALTERNATIVE ACCOUNTING TREATMENTS OF ARCNs

	Alternative Treatments								
	Debt Equal to Redemption Value			Debt Equal to Present Value of Redemption and Periodic Payments			Debt Equal to Present Value of Probable Future Payments		
Event	*(1)*			*(2)*			*(3)*		
(a) Issuance of Notes	Cash	45,400,000		Cash	45,400,000		Cash	45,400,000	
	Notes Payable		22,700,000	Notes Payable		22,700,000	Notes Payable		33,545,673
	Contributed Capital		22,700,000	Premium on Notes		11,350,000	Contributed Capital		11,854,327
				Contributed Capital		11,350,000			
(b) Interest Payment for First Year	Interest Expense	5,423,484		Interest Expense	5,362,875		Interest Expense	5,283,443	
	Cash		5,423,484	Premium on Notes	60,609		Notes Payable	140,041	
				Cash		5,423,484	Cash		5,423,484
(c) Interest Payment for Second Year	Interest Expense	5,423,484		Interest Expense	5,353,329		Interest Expense	5,261,387	
	Cash		5,423,484	Premium on Notes	70,155		Notes Payable	162,097	
				Cash		5,423,484	Cash		5,423,484

exceed the rate of interest that the company would have paid on straight debt. This may be true even ignoring any increases in the periodic payments. For example, NICOR's annual payments of $5,423,484 result in an effective rate of 23.9 percent when computed based upon debt of $22,700,000; however, the rate of interest for the company's straight debt would have been only 15.75 percent, resulting in annual interest expense of $3,575,250 based on the recorded amount of the debt.

The companies using the first approach treated the full amount of the periodic payment as interest to coincide with their treatment for tax purposes. A variation of this first approach might be to record as interest expense only the $3,575,250 representing the amount that would have been recognized as expense on straight debt. The remainder of the $5,423,484 annual payment would be viewed as a dividend associated with the $22,700,000 of contributed capital recorded upon issuance of the ARCN.

The entry to record the $5,423,484 distribution each period if the part-interest, part-dividend approach were followed is:

Interest Expense	3,575,250	
Dividends Paid	1,848,234	
Cash		5,423,484

Thus, even if the redemption value of the notes were considered as debt, it does not follow that all of the periodic distribution need be viewed as interest expense.

Debt Equal to Present Value of Redemption and Periodic Payments

A second treatment found in practice, but used only by NICOR, is to record the debt at the present value of both the periodic payments and the redemption value of the notes. Under this approach, both the periodic payments and the redemption value of the notes represent obligations of the issuer. No portion of the periodic payments is viewed as a distribution of earnings because these payments must be made whether or not the issuer has earnings during the period the ARCNs are outstanding. The future payments, both periodic and terminal, are discounted at the rate that would have been incurred if the company had issued straight debt.

Under this alternative, NICOR recorded the issuance of the ARCNs with entry (2a) in Table 2. The note is recorded at its redemption value of $22,700.000. In accordance with APB Opinion No. 21, a premium is recognized to value the debt at the present value of the principal and interest payments, as follows:

Present value of redemption amount and periodic payments, at 15.75 percent (rounded)	$34,050,000
Redemption value	(22,700,000)
Premium on note	$11,350,000

Interest expense is recognized each year as 15.75 percent of the book value of the debt, and the book value is reduced each year as the premium is amortized. Entries (2b) and (2c) record the interest payments for the first two years, computed as follows:

Year 1

Balance of $34,050,000 × .1575 = $5,362,875

Year 2

First Year Payment	$ 5,423,484
First Year Interest	(5,362,875)
Amortization of Debt	$ 60,609
Original Balance of Debt	$34,050,000
First Year Amortization	(60,609)
Second Year Beginning Balance	$33,989,391
Implicit Interest Rate	.1575
Second Year Interest	$ 5,353,329

THE SUBSTANCE OF ARCNs AND A PROPOSED ACCOUNTING TREATMENT

The financial reporting treatments used in practice (as well as the IRS ruling discussed later) fail to capture the substantive nature of ARCNs. There is every likelihood that the issuer will be required to make the periodic payments until the maturity of the ARCNs, but there is little likelihood that the redemption amount will be paid unless there is a precipitous drop in the value of the company's stock. Holders of the notes share in the appreciation of the stock but receive the higher annual yield associated with the notes. Conversion, therefore, will usually not take place until the holders of the notes are forced to convert; and, because the redemption amount is set far below the value of the stock into which the notes are convertible, conversion rather than redemption is reasonably assured.

Under these circumstances, the periodic payments represent present obligations of the issuer to make probable future sacrifices of economic benefits. The redemption amount, however, will probably not be paid. Instead, the notes will normally be converted into stock immediately before maturity. The treatment that best captures the likelihood of the situation and is most consistent with the concept of a liability set forth in the FASB's conceptual framework as defined in Statement of Financial Accounting Concepts No. 6 [1985, par. 35] is to record the present value of the periodic payments as debt and the remainder of the issue amount as equity. Entry (3a) in Table 2 illustrates this approach for NICOR.

The redemption amount is not recorded because it is unlikely to be paid, and the 25 periodic payments of $5,423,484 each are discounted to their present value of $33,545,673 at the rate of interest (15.75 percent) that NICOR would have incurred in issuing straight debt. Interest expense is recognized subsequently as 15.75 percent of the debts' book value; entries (3b) and (3c) illustrate the periodic payments for the first two years. Interest expense in the first year is $5,283,443 ($33,545,673 × .1575) based upon the original amount recorded as debt in entry (3a). Interest expense in the second year is $5,261,387 ($33,405,632 × .1575) based upon the debts' book value after a $140,041 reduction in the first year. None of the periodic payment is viewed as a dividend so long as the amount of the periodic payment does not change.[9]

This view of ARCNs, although not found in practice, is consistent with generally accepted accounting principles overall and with such pronouncements as APB Opinion No. 21 [1971]. In effect, the ARCN represents two securities: (1) an equity security with a "bailout" or put feature (i.e., the redemption amount); and (2) a debt security entitling the holder to receive a stream of periodic cash payments.

Treating the present value of the periodic payments as debt is justified because these payments will be made by the issuer until conversion of the note, and conversion cannot be assumed to be probable until immediately prior to maturity. Not treating the redemption amount of the note as debt is justified because the notes seldom will mature; they generally will be converted immediately prior to maturity.

PROBLEMS OF IMPLEMENTATION

There are a number of implementation questions about the proposed approach: (1) the proper discount rate or price to use in allocating the issue proceeds between debt and equity; (2) the treatment of changes in the periodic payments; and (3) the assessment of the likelihood of making future payments.

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[9] The problem of changes in the periodic payments is discussed in more depth in the following section.

Determination of Discount Rate or Debt Price

The proposed treatment recognizes that ARCNs are composed of two elements incorporated into the same instrument and separates the accounting aspects of the debt and equity elements. This is accomplished by pricing the debt element based upon an estimate of the yield that would be required to issue identical nonconvertible securities. The general approach is not novel, having been suggested many years ago in relation to convertible bonds (e.g., APB Opinion No. 10 [1966], and Ford [1969]).

APB Opinion No. 14 [1969, par. 7 and 8], however, presented two major arguments against separately accounting for the debt and equity elements of convertible bonds. First, the alternative choices between conversion of the bonds and redemption were viewed as mutually exclusive with only one being consummated. This in turn was viewed as implying that only one element, either debt or equity, could be recognized upon issue. However, this line of reasoning never made clear why only one element could be recognized at issue when there was complete agreement that the price paid for a convertible bond included an incremental amount for the option of acquiring stock. In all other cases, stock options are recorded as paid-in capital whether or not exercised. This argument is inconsistent with the underlying substance of convertible debt and the treatment normally accorded stock options, and it does not seem to justify ignoring the equity aspects of the original issuance.[10]

A second argument against recording a portion of the proceeds received on the issuance of convertible bonds as equity was that a reasonable estimate could not be made as to the portion of the issue price related to the stock option. While that may or may not have been the case in the 1960s, such estimates clearly are possible today.[11]

When considering financing alternatives, underwriters routinely estimate the interest yield required to sell the company's straight debt. Therefore, the price at which the company's convertible debt would sell without the conversion feature can be estimated with reasonable accuracy, with the difference being allocated to paid-in capital. Adjustments could be made for any slight differences in terms because of convertibility (e.g., specific call features); underwriters and traders routinely make such adjustments when pricing bonds and have considerable experience in adjusting for different features.[12] In fact, the whole approach to pricing bonds at issuance is one of adjustment. The typical approach is to determine the yield on treasury notes or bonds of the same maturity and adjust for differences in rating or risk levels; additional adjustments are made for specific features and characteristics of the bonds being priced.

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[10] Interestingly, APB Opinion No. 14 does permit the recording of paid-in capital if convertible bonds are issued at a substantial premium, even though whether a given type of bond is issued at a premium or at par can be affected by the nominal interest rate without changing the basic features of the instrument.

[11] Much of the material in this section is based upon extensive discussions with professional bond traders and underwriters having experience in pricing convertible and straight debt. The information was gathered from interviews (some by phone) with 11 bond traders and underwriters employed by seven different firms located in St. Louis (three), New York (two), Chicago (one), and Charlotte (one). The firms involved included two major full-line financial services companies, three medium-size full-line brokerage firms making markets in regional debt issues, and two major dealer-only bond trading firms. The discussions, held during the spring and summer of 1987, encompassed the initial pricing of convertibles and straight debt as well as subsequent pricing (of unlisted bonds) by market makers in the after-markets.

[12] The finance literature describes theoretical models for pricing bonds but includes no discussion of the practical techniques to be used in an actual underwriting or trading situation. Even the formal training that traders receive focuses primarily on the institutional and legal aspects of the securities markets rather than the techniques of pricing. Traders indicate that they gain their

Changes in Periodic Payments

In all cases of issued ARCNs, the base interest payment could not decrease from the initial amount and, therefore, was required to be made each period as long as the notes were outstanding. Because of the relative certainty of these payments, an amount equal to the present value of the future payments based upon the initial amount could be recorded as debt under the proposed treatment.[13]

Adjustments in the periodic payments based on changes in dividends are somewhat different from scheduled changes in the base payment. There is a high degree of uncertainty surrounding the amount of such adjustments in the future. The amount of additional payments depends solely on future dividend increases. If dividends are not increased, the future periodic payments on the ARCNs will continue at the base amount, including any scheduled adjustments in the base. Even after increases occur in the periodic payments due to increases in dividends, the terms of the four issues are such that those increments would be eliminated in future periods if dividends were to decrease. Because of the high degree of uncertainty as to whether there will be adjustments in the payments and the amount of those adjustments, they would not be included when computing the present value of future payments.

Increments in periodic payments made on ARCNs based on increases in dividends could be recognized each period as the amounts accrue. While the increment in the periodic payment has been treated as additional interest expense in practice, an argument could be made that it is a distribution related to the equity element of the ARCNs. The higher payment comes only with management's discretionary decision to increase the common dividend. Such a decision would often be associated with a rising stock price which, in turn, would increase the ARCN's stock value. As the company's stock increases in value, the ARCN becomes more of an equity instrument, with the probability of ultimate conversion increasing and the bulk of the instrument's value coming from the stock into which it is convertible. Because holders of ARCNs already are treated as suppliers of equity capital under the proposed approach (except for the present value of the base payments), the additional payment could be viewed as a dividend rather than as an expense.

The Likelihood of Future Payments

One of the keys to ascertaining the substance of financial instruments, is to understand the intent of the arrangement and to be able to assess the likelihood of future payments under the agreement. The approach to assessing the likelihood of future payments suggested here does not represent a departure from generally accepted accounting principles but rather an extension of currently acceptable practice.

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expertise in pricing bonds and adjusting for different features through experience rather than from any formalized pricing rules.

[13] For Borg-Warner and Hercules, the base payment was scheduled to increase and could not subsequently decrease. In such a case, the increment also should be included in the present value computation of the debt because of the relative certainty of the payment.

Currently, the present values of both the principal and interest payments related to traditional convertible debt, as well as the amount associated with the conversion option, are recorded as debt at the time bonds are issued. Although companies issuing convertible debt typically expect the bonds to be converted at some time, the chances of conversion are so uncertain that conversion is recognized only when it occurs [Kieso and Weygandt, 1986, p. 695]. This uncertainty can be viewed in the context of SFAS Statement No. 5, "Accounting for Contingencies" [1975, par. 3], with the conversion probability at the time of issue normally assessed as "reasonably possible" but not "probable." The same view is taken from an accounting perspective with respect to a call feature. While companies often expect to call their debt (convertible or not), no recognition is given to the potential call until it occurs because of the uncertainty surrounding the anticipation of future events that might lead to the call.

The approach suggested here for dealing with ARCNs and other types of financial instruments deviates from the provisions of APB Opinion No. 14 but otherwise follows practices currently in place. For each issue, the conversion ratio, redemption value, and other key features of the security would have to be examined and a judgment formed as to whether ultimate conversion was, in the terminology of SFAS Statement No. 5, probable. ARCNs with a maturity value of 50 or 55 percent of face value are highly likely to be converted; conversion is probable. Thus, the present value of the maturity amount would not be treated as debt. For other types of financial instruments, such as the newer ARCNs discussed in a following section, the features may be such that conversion is uncertain and the maturity amount would be viewed as an obligation of the firm.

On the other hand, elimination of periodic payments on the original type of ARCNs through conversion could not be viewed as probable. In fact, it is probable that such ARCNs would not be converted until called, given interest payments greater than dividends, the ability to share in the appreciation of the stock, and a floor on the amount to be paid at maturity. Therefore, consistent with current practice, it is assumed that the interest payments on convertible debt will be made because it is only possible, not probable, that the bonds will be converted prior to maturity.

Similarly, the existence of a call provision normally would have no effect on the way an ARCN or other type of financial instrument was recorded. If and when a company will call its bonds is extremely uncertain. In fact, companies tend to delay forcing conversion through exercise of the call well beyond the time that finance theory indicates they should (e.g., see Brealey and Myers [1984, p. 532] and Ingersoll [1977, p. 320]). Calls are often triggered by events that are extremely difficult to predict (e.g., dramatic changes in interest rates, new tax legislation). Therefore, and again consistent with current practice, a company's obligation would be considered unchanged by the existence of a call provision until the call actually was exercised. At that time, the call and resulting conversion, if conversion results, would be accounted for as they are currently: the remaining present value of the future interest payments would be transferred to equity.

INCOME TAX TREATMENT OF ARCNs

For income tax purposes, a determination must be made as to whether the periodic payments associated with any financial instrument are tax-deductible interest or nondeductible equity distributions. Over the years, the tax law, including the Tax Reform Act of 1986 and current Treasury Regulations, have given little, if any, guidance for the differentiation of debt from equity and the associated differentiation of interest and dividends. The approach used by the IRS has been one of examining each instrument for its substance and making an individual determination for each.[14]

The Position of the IRS

In evaluating the nature of a capital interest in a corporation, the IRS seems to take the view that an instrument is either entirely debt or entirely equity. In the case of ARCNs, the IRS [Rev. Rul. 83-98] decided that these instruments were entirely equity interests:

> Because of the very high probability that all of the ARCNs issued will be converted into stock, the ARCNs do not in reality represent a promise to pay a sum certain.

Other factors the IRS viewed as supporting a determination of an equity interest included [Rev. Rul. 83-98]:

1. The guaranteed annual return is low in relation to the original investment.
2. Much of the future annual yield from ARCNs is discretionary, based on the level of dividends declared on the common stock.
3. The ARCNs are subordinated to the general creditors of the issuer.

In response to the IRS ruling, three of the four firms that had issued the original ARCNs called their notes. Hercules, however, continues to take interest deductions on the notes.

Inconsistencies of the IRS Position

In examining the stance of the IRS, several observations appear warranted. First, in ruling that ARCNs are entirely equity, the IRS failed to consider that a single instrument might consist of both debt and equity. The dual status of hybrid instruments, however, has been recognized by the Tax Court in the case of *Richmond, Fredericksburg and Potomac Railroad Company v. Commissioner of Internal Revenue* [1975] (upheld on appeal).

Second, the position of the IRS seems to conflict in part with proposed Treasury Regulations [1980, sect. 1.385] that were issued and later withdrawn.[15] For example, the value of the ARCNs as straight debt would have considerably exceeded 50 percent of the value as issued—an indication of debt status under the proposed regulations. Further, these instruments provided for fixed base payments at specified dates, another of the proposed regulations' indicators of debt. While the regulations were withdrawn before becoming effective, they do give an indication of the thinking of the IRS regarding the characteristics of debt.

Additionally, in considering the substance of ARCNs, the IRS apparently failed to consider the fixed nature of the base payments separate from the discretionary increases and, instead, treated the full amount of the periodic payments as discretionary. However, the periodic payments, but not the terminal payment, would seem to qualify as debt. If so, the periodic payments should be discounted, in accordance with the IRS's rules regarding implicit interest [Internal Revenue Code, sect. 483], to their present value at the date of issuance. The subsequent amortization of the discount then should qualify as deductible interest.

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[14] While the Internal Revenue Code [sect. 385] mandated that the Treasury Department issue regulations differentiating debt and equity interests, the proposed Treasury Regulations [1980, sect. 1.385] were withdrawn before going into effect. Although the Treasury Department is continuing to work at developing regulations, none currently exist.

[15] The proposed regulations mandated by sect. 385 of the Internal Revenue Code listed a number of factors for distinguishing between debt and equity. Included were [sect. 1.385-5]: (1) name of issue, (2) intent of issuer, (3) fixed or ascertainable maturity date, (4) certainty of payment of principal, and (5) certainty of payment of interest. The proposed regulations further indicated that hybrid securities should be treated as stock if the fair value of the instrument without its equity feature would be less than 50 percent of the fair market value of the instrument with the equity features.

Recent Issuances of ARCNs

In the past several years, a few companies, including Landmark Bancshares, Corp., and Commercial Bankcorp of Colorado, have issued financial instruments called adjustable rate convertible notes. While carrying the same label as the original ARCNs, these newer securities differ in substance. The major features of these notes are that the maturity value is equal to the face amount, the interest rate is adjusted based on an external measure such as the prime rate, and the notes are convertible into a fixed number of shares having a market value at the issuance of the notes less than the face amount of the notes. The IRS issued Revenue Ruling 85-119 designating as debt the one new ARCN examined and permitting the deductibility of the periodic payments as interest.

As with any of the new hybrid types of securities, the framework presented earlier could be used in analyzing the substance of these new notes and determining the appropriate accounting treatment. Because the terms of the new ARCNs do not necessarily favor conversion, ultimate conversion is uncertain and the present value of both the maturity value and the periodic payments should be recorded as debt. A portion of the issue proceeds could be allocated to the conversion feature based upon what the notes would have sold for without the conversion feature. While the overall analytical framework for analyzing these notes would be the same as for the original ARCNs, the accounting treatment would be different because the substance of the notes is considerably different.

Conclusions

The financial and tax reporting procedures that are appropriate for new types of financial instruments are not always evident, nor is clear guidance available from existing professional pronouncements. In addition, both the issuers and the IRS focused on particular features of the original ARCNs to support desired treatments, while ignoring other features crucial to understanding the overall substance. Finally, while the accounting and tax treatments of these securities may be in accordance with the letter of the law, vague as it is, they fail to comply with the spirit of reporting economic substance.

In dealing with ARCNs, as well as other new types of instruments, there is a need to determine what the instrument is intended to accomplish and the likelihood of it doing so. If current authoritative standards instructed issuers of convertible debt securities to assess the likelihood of potential future sacrifices of economic resources, and to record the present values of probable future sacrifices as debt, with all additional proceeds being treated as equity, then the available methods for recording all convertible securities and hybrid financial instruments would be reduced to a single conceptually sound approach.

Focusing upon economic substance provides for a consistent approach to dealing with all financial instruments as opposed to treating each type separately, and could lead to a common treatment of financial instruments for both financial and tax reporting.

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Richard P. Brief, 520 Tisch Hall, 40 W. 4th St., Schools of Business, New York University, New York, NY 10003.

AHMED BELKAOUI, *Quantitative Models in Accounting* (New York; Westport, Connecticut; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. xvi, 359, $55.00).

Quorum Books is marketing this book as a professional guide for managers who use quantitative techniques for solving accounting-based problems. The cover of the book further states that the book should prove a useful guide to such practicing professionals as corporate planners, economists, and upper-level staff. In the academic world, the book may prove useful to advanced management accounting students, MBA students, and faculty. I personally find the book a good source of reference.

The accounting-based problems addressed in the text relate to management accounting, and the quantitative models are more sophisticated than the typical cost accounting textbook. For example, the cost-volume-profit analysis addresses uncertainty, and cost estimation includes regression and learning curve analysis. The topical coverage, then, is that of an advanced cost/managerial course at either the upper-level undergraduate or master's level.

Belkaoui organizes his book into two distinct parts. The first part, which consists of the first three chapters, reviews the general quantitative tools necessary to understand the accounting models in the latter part of the book. Chapter 1 provides a review of mathematics, including such topics as linear equations, exponents, logarithms, and simple calculus. Chapter 2 reviews probability and statistics, including various theoretical probability distributions. Finally, chapter 3 reviews matrix algebra and also presents the reciprocal-services and matrix approach to cost allocation.

The second part, the major portion of the book, presents various quantitative accounting models. Chapter 4 addresses cost-volume-profit under uncertainty. Chapters 5 and 6 focus on cost estimation with regression analysis and learning curves, respectively. Chapter 7 presents linear programming for product-mix and transfer pricing situations. Chapter 8, approaches to cost control, includes statistical approaches for variance investigation using controls charts and a decision-theory approach using Bayesian analysis. Chapter 9 presents inventory control and valuation models. Chapter 10 discusses capital budgeting. Finally, chapter 11 provides network analysis using PERT/CPM.

In the appendices of several chapters Belkaoui provides reprints of a variety of related articles from such journals as THE ACCOUNTING REVIEW, *Journal of Accounting Research*, and *Cost and Management*. For instance, chapter 8 on cost control approaches includes as appendices reprints by Jacobs [1983] and Kaplan [1975]. I think selected reprints can be very useful in a text of this nature and, for the most part, approve of Belkaoui's selections.

Other positive aspects of the book are the topical selection and the abundant use of examples. I wholeheartedly approve of the selection of advanced quantitative models in this book. Further, Belkaoui generally reviews simpler models pertaining to a particular topic before expanding to the more advanced models. For example, in chapter 4 on cost-volume-profit analysis, the deterministic breakeven model is reviewed prior to incorporating uncertainty. All of the models throughout the book are illustrated with representative examples.

I would think that most professionals choosing to implement any of the models presented by Belkaoui would welcome the aid of computer software. As a procedural guide, the book could be improved by presenting the use and interpretation of typical computerized versions of the models (probably as additional appendices).

As expected of any first edition, this book has several errors throughout. Most of the errors are notational in nature with the highest frequency in the first three review chapters. I was fortunately provided with an errata sheet which you should insist upon when obtaining the book. Unfortunately, even the errata sheet contained a few errors, and it did not note every error in the book. In general, the errors are relatively minor and do not detract from the model presentations.

A troublesome aspect of the book is that explanations are often too brief and often rely too much on the reader's ability to interpret the mathematical notations. Therefore, presumably for the sake of brevity, there is a tendency to oversimplify or be slightly misleading. I understand the need for conciseness in a guide developing so many different models, but accurate interpretations need not be sacrificed. Here's a simple example. In describing elimination or substitution as alternative methods for solving a system of two linear equations $(A_1x+B_1y=C_1;\ A_2x+B_2y=C_2)$ the text states:

> By elimination, the method *will consist of* [emphasis added] multiplying the first equation by A_2 and the second equation by A_1, subtracting to eliminate x, solving for y, and obtaining x by substitution in either equation [p. 3].

Certainly this is *one way* to use elimination, but it is *not the only way*; I think that should be made clear in any description of the elimination method.

Despite these criticisms, I feel that this book is an excellent source of reference for anyone familiar with quantitative modeling. However, partly due to the heavy notational reliance, I question whether managers or students unfamiliar with general quantitative techniques could use the text to learn the various models. My concern is strengthened because there are no exercises or problems at the end of the chapters. This omission is probably because the book is designed as a procedural guide rather than a textbook. Perhaps the term reference guide is more appropriate.

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FREDERICK D. S. CHOI and KAZUO HIRAMATSU, Editors, *Accounting and Financial Reporting in Japan* (Workingham, Berkshire: Van Nostrand Reinhold (U.K.) Co., Ltd., 1987, pp. xiii, 276, $49.95).

This book is a most welcome contribution to the relatively small collection of English language material on accounting and corporate reporting in Japan. In the introduction to the book the editors refer to their objective of helping to bridge the gap between the growing number of people and organizations interested in understanding Japanese accounting and financial disclosure practices, and the relatively small amount of accessible material on the subject. The book makes major and valuable steps towards fulfilling this objective.

Edited by Choi and Hiramatsu, the book comprises 15 chapters contributed by a number of Japanese academics, accounting practitioners, and corporate executives. Readers may choose to focus just on the chapters most relevant to their interests. However, the book is comprehensive in coverage and the chapters, while self-contained, are logically ordered and the greatest benefit is, therefore, to be obtained from reading the entire text.

The first chapter provides an overview of the scale of Japanese corporations and stock exchanges, drawing comparisons with other major nations. Chapter 2 then examines in more depth the characteristics of Japanese corporate structure and decision-making drawing useful comparisons with the U.S. Chapters 3 through 6 introduce and outline the major aspects of corporate reporting regulation in Japan: the promulgation and development of accounting standards, disclosure regulations, and reporting practices; the influence of tax law on financial disclosure; and auditing regulations and practice. These chapters are concise and clearly presented, making good use of stock exchange and ministry statistics and survey data. Problems and recent changes to regulations and practice are highlighted.

Chapters 7, 8, and 9 proceed logically to give an in-depth analysis of: (i) the reporting practices of domestic Japanese companies, (ii) the financial disclosure prepared by Japanese companies for foreign users, and (iii) the disclosure practices of foreign companies in Japan. The analyses are well supported by survey data and a comprehensive example of the financial disclosure of major Japanese companies is provided by Matsushita Electric Industrial Co.

Chapter 10 discusses management use of accounting information, explaining and highlighting the cost accounting methods preferred by management. Chapter 11 provides a very useful overview of the long run performance of Japanese companies providing explanations for changes in rates of profitability. Comparisons are drawn with the U.S.

Chapters 12, 13, and 14 are well linked providing first a clear description of the development and role of the accounting profession in Japan, and then an examination of the system of accounting education. Chapter 14 focuses on accounting research in Japan detailing research interests and activities of Japanese academics.

The last chapter of the book provides an extensive list of information sources for foreign readers. A short description of each source is provided together with the price in yen and where the material can be obtained. This is a very useful contribution.

The book has a number of important strengths. First, it is written by Japanese authors with access to detailed and up-to-date information on accounting and reporting practices in Japan. Second, it draws on the experience and expertise of not only Japanese accounting academics but also practicing CPAs and corporate executives. Throughout the book care is taken to highlight recent changes in corporate reporting and financial markets. These changes relate not only to regulatory requirements but also in the pattern of corporate behavior. Problems with the existing disclosure system are raised. Hence, for the non-Japanese reader the book provides insights into those aspects of accounting and reporting which Japanese experts regard as important, different, similar, and problematic.

A third strength of the book is the wealth of official statistics and survey material it contains. Much of the survey work has been conducted by Japanese accounting academics, and the large Japanese audit corporations.

In summary, the book makes a very valuable contribution. It is comprehensive in its coverage and clearly presented and illustrated. It will be a most useful book not only for academics interested in international accounting but also for the large accounting firms and the growing number of organizations interested in conducting business or raising funds in Japan.

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IAN GRIFFITHS, *Creative Accounting* (London: Sidgwick & Jackson, 1986, pp. 190, £12.95).

With alliterative chapter titles like "How to Get Around Goodwill," and "How to Tamper With Taxation," I had a feeling from the start this book would make for interesting reading. Griffiths, a business writer for *The Times* and *Accountancy Age*, with much wit and sarcasm, takes on the accounting world by identifying the creative reporting techniques employed by managements in recent years. He contends that the use of imaginative—defined as misleading—accounting techniques is rampant and describes the more egregious ones through illustrations taken from actual British reports.

Griffiths contends that the line between creative accounting and outright manipulation of financial reports is fine, a contention that should sound very familiar to students of U.S. external reporting. The topics covered are many of the same addressed by U.S. critics of financial reporting. Off-balance sheet financing, presentation pampering (to borrow more of Griffiths' alliteration), income smoothing through expense maneuverings, to name a few, are topics addressed by Griffiths in an interesting (and non-technical) manner. The book is not written for the accountant necessarily, and the only problem a U.S. reader will have is with terminology differences between the British and American reporting systems. Once "the City" is understood to mean "Wall Street," "stock" is understood to mean "inventory," and a few others, the terminology problem can be overcome.

As a book attempting to dispel the notion of objectivity in financial reporting, it makes the case very well. As Griffiths states, "The myth that the financial statements are an irrefutable and accurate reflection...must be exploded once and for all" (p. 190). He makes his points repeatedly through entertaining examples, and it's fascinating to read about companies not as familiar to us as the GEs and GMs of the world. He is blatant in his criticism—"British Airways has something of a reputation for playing around with the lives of its other aircraft and a review of their accounts over a period of time illustrates this'' (p. 93)—and anyone curious about whether reporting war stories of the ilk we hear about are unique to the U.S. just needs to read Griffiths' book for the answer. He points out through illustration what is known by all good financial analysts: financial reports, without a healthy dose of skepticism and reinterpretation, are not worth very much.

While Griffiths' work is good at describing how the British books are "cooked," it's not as good at explaining why the reporting system is the way it is. He clearly feels management has the upper hand, and only by the British standard setting body issuing more detailed accounting standards will things improve. In addition, he recommends establishing a British SEC-type agency so that compliance with accounting standards is enhanced. The basis for this recommendation is not discussed, however, and it's not obvious to me that the U.S. system is the model case. Furthermore, he spends very little time describing the inherent limitations of all quantitative reporting—converting actions to numbers, aggregation, etc.—but continuously denigrates the system, placing all the blame on management. While I don't believe corporate managements are overpopulated with angels, all the blame does not rest on them.

Griffiths' book, although a little short on theory, is long on providing an interesting and provocative view of the current reporting system followed by British companies. Rather than listlessly limping along through legions of limited ledger data, Griffiths suggests that an understanding of the substance behind the accounting numbers can lead to a more meaningful deciphering of management maneuverings. I concur completely.

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WILLIAM D. HALL, *Accounting and Auditing: Thoughts on Forty Years in Practice and Education* (Chicago: Arthur Andersen & Co., 1987, pp. 81, no charge).

This slim little volume contains 13 essays plus a preface in 81 pages; each chapter thus averaging barely six pages. Accordingly, one should not expect depth on any subject. The author plainly asserts this; it is not a research monograph. Also, unlike George O. May's *Twenty-five Years of Accounting Responsibility*, it does not develop major trends in accounting development or address any major accounting issues of today with the possible exception of cash value and cash flows.

Nevertheless, it is an interesting and readable book about the accounting profession and its policies and reactions to astounding environmental and economic changes during the past 40 years. Also, it is one of a very few books from the profession in the recent decade and, thus, a welcome addition to the literature. More specifically, it is one individual's professional views about the changing business environment and the profession's adjustment to these changes. The book should be taken for what it is—an introspective view of the profession from a successful professional.

The author's 13 essays cover a broad spectrum: Students and their education, continuing education for professionals, on-the-job training, desirable personal characteristics, the profession and society, scope of services, litigation and its impact on auditing efficiency, rules vs. objective reporting, theory vs. practice, the Conceptual Framework, and the AA&Co panacea—fair value accounting. Throughout the essays are upbeat, reflecting the author's well-placed trust in "old-fashioned" values of hard work, integrity, sound judgment, curiosity, and independence—all tempered to the public good and forged in the crucible of his rewarding forty-year experience.

His solutions, too, are reasonably predictable. Students should be trained in quantitative methods and specializations, but have a general grounding in the humanities and communication skills. On the profession's problems, the author supports self-regulation, deplores the schism between practice and academia, and believes that strong ties and intercommunication would do much to solve this problem. He also believes that CPAs' scope of service should not be limited, and supports the studies that have all shown that management advisory services and tax work do not interfere with auditor independence and, indeed, that these activities are beneficial to clients. Finally, he addresses the litigation issue and develops a good argument for the inimical effects of litigation on audit procedures, especially the opportunity costs of excessive, unnecessary, and protective audit practices. This is a facet few have addressed.

I found the book interesting, easy, and enjoyable reading. It is a constructive and welcome antidote to disparaging critiques from certain quarters of the press and the Congress. The author's views are important to an inquisitive society that apparently wants to know more about what makes an auditor tick. Also, the book should be important to prospective employes of CPA firms, i.e., accounting majors, but even more so to those students in search of a major. The message is clear—it is a satisfying and honorable profession with sufficient problems to make it interesting, frequently exciting, and sometimes exhilarating. And, the price is right. Accounting departments could do well by having copies available to prospective majors, and accounting societies such as Beta Alpha Psi could use it to stimulate student discussions.

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DAVID F. HAWKINS, *Corporate Financial Disclosure, 1900–1933*, Accounting Thought and Practice Through the Years Series (New York and London: Garland Publishing, Inc., 1986, pp. 529, $75.00).

A harbinger of new economic times or a soon-to-be-forgotten scare? The market crash of October 1987 has spawned countless comparisons with a previous October crash, Black Tuesday 1929. While pundits may debate whether Black Tuesday caused the Great Depression or was merely a symptom of misguided trade policies, there is little doubt that it triggered the regulatory reforms that ushered in the Securities and Exchange Commission and modern financial accounting. Amid calls for a new round of regulatory reforms, *Corporate Financial Disclosure, 1900–1933* by David F. Hawkins is particularly timely reading.

Written in 1962 when John Kennedy was president and the Accounting Principles Board was just three years old, *Corporate Financial Disclosure, 1900–1933* was Hawkins' doctoral thesis at Harvard. A historical survey of the economic, social and political events, trends, attitudes, and practices that culminated in the passage of the 1933 Securities Act, the work could have been subtitled "A Management Guide to Avoiding New Disclosure Regulation." Motivated by his perception of mounting criticisms of accounting disclosures, Hawkins warns managers to voluntarily reform their reporting practices or else risk additional governmental requirements.

Hawkins' account of the evolution of disclosure regulations in England and the U.S. makes the threat seem real enough, with successive waves of regulatory fervor rising and falling with business crises and recoveries. The speculative excesses of the South Sea Company led Parliament to pass the so-called Bubble Act of 1720, "to Restrain the Extravagant and Unwarrantable Practice of Raising Money by Voluntary Subscriptions for carrying on Projects Dangerous to the trade and Subjects of the Kingdom." However, within five years the capital demands of the industrial revolution forced its repeal.

In 1844 another round of speculation led Parliament to require that prospectuses be registered and their contents prescribed by law so that "at least, the ignorant may not be so misled by the example of persons of weight and intelligence." The 1844 Act required registered companies to publish annual reports containing full and fair balance sheets, audited by one or more auditors, and even included an anti-fraud provision making misleading financial disclosure a misdemeanor. However, with the return of prosperity the filing requirement was dropped because it was "found to be very bothersome to the promoter" and an 1856 act swept away the remaining accounting, auditing, and disclosure requirements. Subsequent financial crises in 1866 and the 1890s led Parliament to re-introduce many of these same provisions, culminating in the Companies Act of 1900 that served as a model for disclosure regulation in the U.S.

Hawkins argues that in the U.S. demands for greater corporate disclosure became part of a broader campaign to redress big business evils. His account of the Progressive era (1900–1917) details the rise of organized labor and the childhood rights movement and the chorus of business critics that included Presidents T. Roosevelt, Taft, and Wilson and authors Jack London and Upton Sinclair. In response to the critics' charges of monopoly, concentrated power, and worker exploitation, big business executives were often disorganized and defensive, with one testifying before the Industrial Commission that "those who attack big business are parasites."

Nevertheless, the Progressive era ended without the enactment of significant disclosure legislation. Hawkins' observation that many reformers viewed greater financial disclosure as a means to an end may explain this result. Having accomplished many of their objectives on other fronts, the reformers may have had little zeal for tackling the arcane details of accounting disclosures. Amid the prosperity of the Roaring '20s, public interest in disclosure reform once again waned—until Black Tuesday.

Hawkins' historical survey leads him to conclude that (1) the standards by which financial reporting practices are evaluated are, in the long run, determined by persons external to the firm and (2) that when management's financial disclosure standards persistently lag behind these external standards, regulation will result. Implicit in his reasoning is the plausible assumption that financial crises will periodically occur and that at those times business critics will have the upper hand. However, while history may tend to repeat itself, it may not repeat itself in precisely the same way.

In 1962, when the Dow stood at 710, a young Hawkins ventured that he was "not so sanguine as to believe that the present dizzy heights reached by the general level of stock prices will persist forever." He predicted that the next round of disclosure reform would extend disclosure requirements to annual reports. On October 19, 1987 the Dow fell by over 500 points but few calls for disclosure reform have been heard.

Hawkins' prognostications raise a key question: Why did accounting disclosures become a target for reform in 1929 but not in 1987? His analysis provides some clues.

Between 1900 and 1930 the number of people owning stocks increased dramatically from 500,000 to 10 million as firms increasingly sought capital beyond money center banks. However, as late as 1930 no state required disclosures directly to the investing public. Also, in spite of public apathy, sporadic efforts during the 1920s by the American Institute of Accountants under George O. May, the Federal Reserve System, and the New York Stock Exchange and others kept the disclosure issue alive. In fact, a 1926 article by Harvard Professor William Ripley on reporting deficiencies caused such a sensation that the market plunged two days before it hit the newsstands and President Coolidge was spurred to reaffirm that corporate disclosure was the domain of the states.

Even so, Congressional hearings into the causes of Black Tuesday did not immediately focus on the adequacy of financial disclosures. However, by a curious twist of fate, Ripley's student Roosevelt was the Democratic candidate in the 1932 elections. A federal securities statute became a Democratic Platform plank. On March 29, 1933, within one month of taking office, President Roosevelt called for legislation requiring that "every issue of new securities to be sold in interstate commerce [...] be accompanied by full publicity and information."

Investment bankers rather than managers have become the villains of the 1987 crash. SEC probes of insider trading abuses on Wall Street were well publicized prior to October 19. Automated trading schemes have become the focus of regulatory reforms. (Given the propensity of politicians to "do something" in the wake of a financial crisis, it is interesting to speculate on the course events may have taken if the SEC investigations had not been underway.) Although critics continue to find fault with certain financial disclosure practices, SEC and FASB requirements and new attitudes by corporate managers have resulted in a public perception that financial disclosures by publicly traded firms are generally fair and complete.

For readers looking for a slick, glossy thriller, this is not the book for you. This is a thesis and it looks and reads like one, with chapter summaries, abundant footnotes, and no pictures. While it does offer several "foldouts," the "figures" they display are of the accounting variety. The analysis also differs from what would be *de rigueur* for a thesis today. Although the author surveyed 500 prospectuses as part of his research, there are no tabulations or statistical analyses to be found, only a few representative examples scattered through the text. However, for the reader interested in a deeper understanding of the events unfolding in the aftermath of October 1987, this book offers a unique perspective by examining from a vantage point in the early '60s the role of financial crisis in shaping the development of financial disclosure requirements.

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Robert A. Howell, James D. Brown, Stephen R. Soucy, and Allen H. Seed, III, *Management Accounting in the New Manufacturing Environment* (Montvale, New Jersey: National Association of Accountants, 1987, pp. xxii, 179, $29.95 paper).

The manufacturing scene in the United States has been undergoing subtle but steady changes over the past 25 years. In effect, those companies with a passion for excellence have been striving to become more competitive in the new world market. In order to achieve this objective, these companies are becoming "world-class" manufacturers with a total quality control system, a just-in-time inventory system, and a computer integrated manufacturing system. A feeling has been growing throughout the business world, however, that management accounting in America has not been adapting rapidly enough to the new manufacturing environment.

Thus, two organizations, the National Association of Accountants (NAA) and Computer Aided

Manufacturing-International (CAM-I), agreed in 1986 to jointly sponsor a research project to evaluate the state-of-the-art of management accounting and control systems. This report, published by NAA/CAM-I, does an excellent job of achieving the primary objective of the research project—describing current practices in the areas of investment justification, cost accounting, and performance measurement. Unfortunately, the prescriptions necessary for the creation of "world-class" management accounting systems are left to be written by researchers performing future research projects in the "Bold Step" series.

The research methodology used to gather information to build the baseline of current cost management practices is detailed in Chapter 1. The first chapter reviews the background of the survey respondents (preparers–79 percent, users–18 percent, others–three percent) and provides an overall analysis of their responses. The questionnaires and the detailed answers thereto which document the research project are included in Appendices.

Chapter 2 summarizes the findings related to investment justification as practiced in the companies surveyed. In general, the findings from this part of the survey support generally held beliefs regarding management practices in U.S. manufacturing companies today, particularly that U.S. companies give too much importance to short-term payback and impact on share price at the expense of the long-term growth needed to effectively and efficiently compete in the new world market. On the whole, however, the respondents believe that the capital investment decision-making process is working.

A review of cost accounting practices found in the survey is presented in Chapter 3. This chapter considers: types of cost accounting systems—job order and process costing, standard and actual costing, full and variable costing; overhead allocation methods—single and multiple rates; types of costs—direct material, direct labor, overhead; cost characteristics—variable, semivariable, fixed. Most respondents are dissatisfied (62 percent of users, 54 percent of preparers) with their current cost accounting systems. So, since these systems are not "tailor-made" to fit the specific manufacturing environment, many line managers tend to ignore cost accounting information for decision-making purposes.

Chapter 4 summarizes the findings related to current performance measurement as practiced in the companies surveyed. Although the responding companies varied greatly in degree of automation, more than 75 percent of the respondents reported using basically the same performance measurement systems. Thus, the finding of a strong degree of dissatisfaction (69 percent of users, 57 percent of preparers) with current performance measurement systems is not surprising. Yet, the respondents are not modifying their systems in either labor intensive or more automated manufacturing environments.

The joint NAA/CAM-I task force recognized the many differences between manufacturers in the defense industry and the survey population as a whole; therefore, Chapter 5 was devoted entirely to defense-oriented companies. This chapter considers investment justification, cost accounting, and performance measurement in the defense industry. The respondents in the defense industry reported greater satisfaction with the investment justification process (58 percent) than with either their cost accounting systems (36 percent) or their performance measurement systems (29 percent). Although the problems highlighted for defense industry companies differ in general from those highlighted for other companies, these problems are significant and they warrant continued study and recommendations for future solutions.

This report does not provide solutions to existing problems in management accounting related to the new manufacturing environment. Rather, it details the first phase of an ongoing process to assess the cost accounting needs of companies in such an environment, a phase that consisted of establishing a baseline of current cost accounting practices. In most regards, implementation of this first phase was quite successful. This report should be examined and debated by academicians generally and managers at all levels of investment justification, cost accounting, and performance measurement. Out of this debate must come positive and useful recommendations for modifying and enhancing current practices, and the use of them by management, to the evolutionary manufacturing environment found in successful world competition today and on into the 21st Century.

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R. H. PARKER, *The Development of the Accountancy Profession in Britain to the Early Twentieth Century*, Monograph

Five (Atlanta: The Academy of Accounting Historians, 1986, pp. ix, 74, $10.00 paper).

The "proper" scope of services for a public accounting firm is a concern that has been discussed by practitioners since public accounting became a profession. Parker's stimulating and informative book concentrates on the development of the accounting profession in Britain, but there is an obvious overlap with the developments in the United States.

This monograph is a study of the evolution of the profession to the status of "independent" and of its changing role in society during the century ending in the early 1900s. The problem seems to have been (and maybe still is): How are qualified public accountants to maintain their independence, integrity, and objectivity while operating in an environment with competing interests?

Questions about the independence and objectivity of auditors were raised early on. In 1849 a Select Committee of the House of Lords discussed this issue. In a very interesting section on selected questions by the Committee, William Quilter, a public accountant, was asked if he thought the present way that railroad accounts were audited afforded the public any protection. He replied:

> It never can,...for this reason: that all of the Companies make it a necessary qualification for an Auditor that he should be a shareholder; the qualification should be that he should not be a shareholder,...he ought to be an independent individual, not interested in putting a favourable appearance upon the face of the accounts.

With most professions there is need for some test of minimum competence. Often, this is considered a function of government. In Britain, entry into accounting has been, and is, under the control of the professional accountancy bodies. Parker puts forth some interesting reasons why government became involved in bankruptcy activities but did not assume control over the audit function.

Professional associations are usually formed to discuss common problems, guard and improve standards of competence, regulate standards of practice, and protect the material interests of members. Therefore, it is not surprising that Scottish accountants in the early 1850s formed an association to influence proposed alterations in a bankruptcy law, which at that time would have affected a large part of their business.

The early accounting organizations were very particular about professional standards. Competence was tested by apprenticeship and examination and most of the training and examinations were of a practical nature. More formal training started around the 1880s with the advent of books devoted exclusively to auditing and accounting. Periodical literature also appeared and ethical and social standards were maintained by the professional groups which could expel a member "guilty of any act or default discreditable to a Public Accountant."

The first texts on auditing listed the detection of fraud as the primary purpose of the audit. While companies were not required to have outside audits, it is suggested that many did so as a precaution to retain public confidence, since ownership and management were becoming separated. Later the objective of the audit was modified "to ascertain and state the true financial position of the company at the time of the audit and his [the auditor's] duty was limited to that."

Early accounting work was strongly connected with the legal profession, especially in the formation of life insurance companies. Accountants were involved with the settlement of estates, bankruptcy, dissolutions, and collecting estate debts. They also engaged in bookkeeping, preparing various types of financial statements, and actuarial work. But it was not until the twentieth century that auditing replaced bankruptcy as the most important activity of public accounting firms.

This publication is Monograph No. 5 in a series sponsored by The Academy of Accounting Historians. It is part of a continuing effort by The Academy to provide a sense of the historical evolution of the discipline. This work is a fine example of institutional history and analysis by one of today's leading accounting historians.

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Rajendra P. Srivastava and N. Allen Ford, Editors, *Auditing Symposium VIII*, Proceedings of the 1986 Touche Ross University of Kansas Symposium on Auditing Problems (Lawrence, Kansas: School of Business, University of Kansas, 1987, pp. 194, $10.00 paper).

As its title indicates, this publication results from the eighth of a series of biennial auditing symposia held at the University of Kansas, and sponsored by Touche Ross & Co., over a period of 15 years. The driving force behind the first seven of these symposia, and the man who they are often closely identified with, is Professor Howard Stettler, who retired from the University of Kansas in 1984.

The overall purpose of the symposia is to bring auditing practitioners and academics together to consider relevant auditing problems. This is done in the format of presented papers with one formal discussant for each. After presenter and discussant have said their piece, the other attendees are given the opportunity to ask questions and make remarks. This may seem a rather conventional format; however, at the Kansas Symposium, half the papers are presented by academics and half by practitioners, and the discussant of an academic presentation is always a practitioner and vice versa. Finally, the first of the eight papers presented is always devoted to some aspect of the history of auditing.

The book subject to this review is the collection of the formal papers and discussants' responses from the 1986 symposium. Unfortunately, the ambiance of the symposium that flows from the fellowship, informal discussion, and interaction of the participants, and that makes such symposia so worthwhile, is not really captured in a publication of this type. One is left with the more sterile set of papers and formal, edited discussants' remarks. Viewed in that light, an academic reader would be critical of the format used for the following reasons: The practitioner papers are not of great interest from an academic or research perspective. Thus, reading them may not be particularly useful. The academic papers may be of interest to academic readers, but the practitioner-discussant's remarks are very shallow and make little contribution to the paper or subject at hand. It is common, for example, for a practitioner who is discussing a more technical research paper, to admit his lack of basis for dealing with the paper in terms of its contents, and to proceed to discuss the subject matter in some other terms. This observation is not meant to be a criticism of practitioners, but simply to point out a weakness that results when viewing the subsequent publication.

Having established a general criticism, let me now comment on the individual papers, and the discussants' remarks to a limited extent. The first paper is entitled "'Under the Spreading Chestnut Tree' Accountants' Legal Liability—A Historical Perspective," and is written by Paul J. Ostling of Arthur Young & Co. (One would presume a member of their legal department.) This paper provides a legal history of accountant's liability from nineteenth century England to the current test of privity and the *Ultramares* doctrine. The paper ends with the author's view of where these trends might take us and what actions should be taken by the accounting profession at this time. The paper's discussant, Thomas A. Gavin from the University of Tennessee at Chattanooga, states, "Paul has done an excellent job of developing the history of accountant's legal liability." I agree, and would find this paper useful background information for the auditing classroom.

The second paper is the longest of the eight, perhaps because it has the most authors as well. The paper is "An Assertion Based Approach to Auditing," by Donald A. Leslie, Stephan J. Aldersley, Donald J. Cockburn, and Carolyn J. Reiter, all of Clarkson Gordon. The paper basically presents Clarkson Gordon's audit approach and includes, for example, illustrative material using some of Clarkson Gordon's standard audit forms. There is really nothing new about assertion-based auditing. It is discussed in the literature and used by most large firms. Therefore, this paper is of some interest, but only as an illustration of how one firm is implementing a broadly recognized concept. The paper does contain an interesting appendix on the use of a Bayesian model for combining information. Unfortunately, the key tables referred to in the appendix are missing from the publication. The discussant of the paper, William L. Felix from the University of Arizona, makes a number of insightful technical criticisms of the paper, to which the authors may have a response but isn't included in the published format.

Dan A. Simunic and Michael Stein of the University of British Columbia presented a paper, "On the Economics of Product Differentiation in Auditing," that analyzes the nature of differentiated audit services and the determinants of auditor choice. This paper represents a review and summary of a number of research efforts concerning the demand side of audit services, contains some interesting conclusions and an excellent bibliography, and would be of interest and assistance to other researchers working in the area of the economic aspects of auditing.

The fourth paper presented is "Unresolved Issues in Classical Audit Sample Evaluations," by Donald R. Nichols (Texas Christian University), Rajendra P. Srivastava (University of Kansas), and Bart H. Ward (University of Oklahoma). This paper primarily considers the problems that arise when the standard error in a hypothesis test using variables sampling differs from that planned. In response to those problems, the authors propose a "balanced" strategy that attempts to balance the losses that might result from Type I and Type II errors using *ex post* sampling data. Unfortunately, the two figures that are referred to in the paper are missing. The discussant of this paper, Abraham D. Akresh of Laventhol & Horwath, develops a number of good practical considerations in the use of variables sampling in auditing. In particular, he notes: "...the costs of training auditors to understand a more complex approach far outweigh the savings resulting from auditing fewer items." This thought should be kept in mind by researchers and teachers in the sampling area.

The fifth paper is a futures paper. It is "The Impact of Technological Events and Trends on Audit Evidence in the Year 2000: Phase I," by Gary L. Holstrum, Theodore J. Mock, and Robert N. West of the University of Southern California. This paper seeks to look at changes in information technology and how they might affect auditing in the future. This is an interesting paper, and although as with all such attempts at predicting the future, one can easily argue with specific points and conclusions, it is a stimulating view that has many implications for teaching and research.

Paper number six is by Thomas P. Bittinger of Touche Ross & Co. and is entitled "Is the Second Standard of Fieldwork Necessary." This is a question that has been debated by the Auditing Standards Board, and is of interest to both academicians and practitioners. The author does a nice job of developing the history of the second standard of fieldwork (which deals with internal control) and the arguments on the question. He concludes with the statement that it should be retained. The discussant of this paper is Andrew D. Bailey, Jr., of The Ohio State University. Bailey argues the question of whether the auditor should be involved with internal control rather than whether the explicit standard is necessary. Therefore, he and the presenter are on somewhat different wavelengths. Nevertheless, Bailey's discussion is a useful "mini-paper" that supplements the practitioner's view.

The seventh paper is really a status report on the development of an expert system in process. It is "Interim Report on the Development of an Expert System for the Auditor's Loan Loss Evaluation," by Kirk P. Kelly, Gary S. Ribar, and John J. Willingham of Peat, Marwick, Mitchell & Co. Those who have investigated the use of expert systems in auditing will be familiar with this project, and others who are curious about such techniques will find the report interesting.

The final paper is also a report. It is "The Work of the Special Investigations Committee," by R. K. Mautz. The work of Professor Mautz and his participation in the self-regulation efforts of the accounting profession are known to most academics and practitioners. This report contains useful information, but no different than seen in the *Journal of Accountancy* or other AICPA publications.

Whether this publication would be considered worthwhile to a particular reader would depend on whether it contains one or more papers that are applicable to that reader's specific interests. Unless, of course, the reader had attended the symposium, in which case it would serve as a reminder of an enjoyable and fruitful experience with colleagues from both academia and practice.

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STEPHEN M. STIGLER, *The History of Statistics: The Measurement of Uncertainty Before 1900* (Cambridge, Massachusetts: Harvard University Press, pp. ix, 410, $25.00).

Until recently there were (essentially) only two books on the history of statistical philosophy and methodology, namely, Walker [1929] and Hacking [1975]. The first traces early signs of statistical thinking and methodology in various domains of empirical science. The second is an inquiry into a broad range of reasons (social, religious, and the natural evolution of empirical science and inductive logic) which simultaneously account for the late emergence of probability (and statistical) thinking. Now, with the publications of Porter [1986] and Stigler's book (reviewed here), this literature has two important additions.

In her recent review of these two new books [*Journal of the American Statistical Association* (December, 1987), p. 1178], Ruth Schwartz Cowan classified Porter's book as an "externalist" account and Stigler's book as an "internalist" account of the subject. Quoting from her review,

> Internalists focus on intellectual history; they try ...to understand the sequence of ideas in a specific field. An internalist account of any single development might run something like this: First *a* said *x*, and then *b* realized that his was wrong, correcting *a* by assuming *y* rather than *x*. [In contrast]...externalists do not believe scientists or historians of science who insist that only "scientific" or "rational" or "logical" arguments

> enter into scientific debate; they are inclined to search for social, economic, and political motivations, hence their name—externalists.

As Cowan noted, that could be expected given the different backgrounds of these two writers. Stigler is a mathematical statistician and Porter's field is history of science.

To a certain extent, the distinction between "externalist" and "internalist" can be used to contrast Stigler's work with the other books on the history of statistics. At the same time, describing Stigler's viewpoint as "internalist" is too narrow as the following quotation from his introduction (pp. 1–2) suggests:

> Statistics, as we now understand the term, has come to be recognized as a separate field only in the twentieth century. But this book is a history of statistics before 1900. Thus, my subject is not the entire development of a single discipline but rather the story of how that discipline was formed, of how a logic common to all empirical science emerged from the interplay of mathematical concepts and the needs of several applied sciences. In exploring the details of that emergence we come to a realization of *what constitutes the essence of this twentieth century discipline and of how the empirical methods of all the sciences have achieved an intellectual identity that goes far beyond the sum of the constituent parts....* [italics added]

Stigler has indeed not attempted a full account of the various social, political, economic, and theological factors that possibly motivated men like Fechner, Galton, and others. However, his work cannot be classified as a narrow account of an internalist. He has provided us with a very learned study with main focus on the (related) problems of combining observations and the measurement of uncertainty in the empirical sciences.

In the first chapter Stigler skillfully describes the early attempts to deal with the problem of combining measurements in Astronomy and Geodesy. These attempts lead to the development of the method of least squares by Legendre and Gauss. The following three chapters discuss the earliest attempts to engage probability theory in developing a sound approach to inference and the measurement of uncertainty. This first part provides an illuminating discussion on the synthesis of the ideas of inverse probability, the central limit theorem, and least squares into a mature approach to the problems of combining measurements and measuring the uncertainty associated with inferences.

The second part of the book deals with developments in the social sciences. A question of interest here is why were social scientists late in adopting existing methods (in Astronomy and Geodesy) for dealing with the problems of combining observations and measuring uncertainty. The problem is raised, but Stigler's answer here is not completely satisfying. The third part of the book discusses the development of mathematical statistics in connection with studies of heredity. Here we find a satisfactory demonstration of an attempt to show how scientific problems shaped statistical methodology and, in turn, that methodology enhanced better and more unified approaches to deal with scientific problems. Some of Stigler's in-depth studies contain revealing technical details and others contain valuable reflections on the early shaping of the different approaches to the inference problem (inverse probability—Laplace, Bayesian—Bayes, a Fiducial approach and a frequentist approach). These portions of the book will be most appreciated by statisticians. Other parts will interest accountants and social scientists, even those with a minimal background in probability and statistics.

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Porter, M. Theodore, *The Rise of Statistical Thinking, 1820–1900* (Princeton: Princeton University Press, 1986).

Hacking, Ian, *The Emergence of Probability* (Cambridge: Cambridge University Press, 1975).

Walker, Helen, *Studies in the History of Statistical Methods* (Baltimore: Williams & Wilkins, 1929).

BRUCE W. TUCKMAN and F. CRAIG JOHNSON, *Effective College Management: The Outcome Approach* (New York; Westport, Connecticut; and London: Praeger Publishers, a Division of Greenwood Press, Inc., 1987, pp. xi, 147, $35.00).

The authors present a model for college management based on measurable outcomes in the areas of teaching, research, and service. Their system has its origin in a large college of education that has seven departments, 22 programs, and 145 faculty. Chapter one is an introduction to the underlying concepts and the background for the book. In chapter two the authors present a description of their outcome management model and brief summaries of several principles which establish the conceptual foundation for their model. Chapters three and four outline their measures of teaching, research, and service. Chapters five and six present the planning foundation for their reward structure. Chapter seven discusses how outcome measures can be used to make decisions concerning the allocation of resources to academic programs. Chapter eight presents the authors' system of rewarding faculty performance based on individual outcome measurements. Chapter nine, "The Bottom Line," summarizes their presentation and discusses several implementation issues.

The authors' proposed system measures and rates faculty output in the areas of teaching, research, and service. Programs are evaluated by aggregating faculty output at the program level. The heart of any such system is the validity of the performance measures and how faculty will be motivated based on the consequent reward distribution.

Their measure of teaching productivity consists of two component measures: number of active doctoral advisees and number of student credit hours taught. At schools without doctoral programs, the sole measure of teaching performance would be student credit hours taught. In their illustration, a faculty member could achieve the highest rating in a semester by teaching 395 student credit hours or just over 130 students (assuming three credit hours per course). No other aspects of teaching performance enter the evaluation equation.

The research component is measured and evaluated based on performance for two criteria: current number of contracts and grants, and the number of journal articles published during the past five years. For schools not heavily involved in contracts and grants, the evaluation would be based on the number of journal articles published during the past five years. The maximum rating is achieved with five articles.

The service component is rated based on an administrator's subjective evaluation of what could best be described as "consulting and service to the university community."

The authors appear to have fallen short of designing a useful system for effective college management. In their quest for simple and objective measures they have adopted surrogates that are woefully inadequate. If faculty were motivated by such a system the outcome could be highly dysfunctional.

Limiting the evaluation of teaching performance to the number of student credit hours taught totally ignores the most important dimension of teacher performance—the quality of teaching. Their system might reward a marginal teacher who taught large elementary sections and punish an outstanding teacher who taught small graduate courses.

Ignoring grants and contracts, the proposed system simply counts the number of journal articles. The authors make no distinction based on quality or likely recognition accruing to the author or university as a result to the publication. Consequently, they would reward, for example, two small, relatively insignificant articles more than one major article that had won national recognition. Again, their system seems to encourage and reward mediocrity, and to punish the pursuit of excellence.

The "performance" of university faculty members is an extremely complex multidimensional phenomenon that defies "measurement" by simple, mechanical rules. As much as everyone involved would welcome completely objective performance measures, we also need subjective measures made by competent and well-intentioned administrators. Most systems normally offer appeal procedures which minimize misuse of power or significant errors in judgment.

This book is disappointing because it proposes simple solutions to a complex problem.

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DAVID TWEEDIE and GEOFFREY WHITTINGTON, *The Debate on Inflation Accounting* (Cambridge, England; London; New York; New Rochelle, New York; Melbourne; and Sydney: Cambridge University Press, 1984, pp. xii, 404, $52.50).

Noting *The Debate on Inflation Accounting* on my desk, a colleague, a quintessential empiricist, commented as to how my reading runs to the irrelevant. This is an accusation with which the authors themselves might agree. As they emphasize in their historical survey, interest in inflation rises and falls with the consumer price index. With inflation rates in most countries at the lowest in decades, it is not imperative that this book be priority reading for accounting standard setters or even academicians.

Too bad. This volume brings to life accounting's rich intellectual tradition and dynamic debates that occurred from the 1920s through the 1970s. Equally important, it gives an explanation, if not a satisfactory rationale, for current inflation accounting practices in many parts of the globe.

Tweedie and Whittington credit several post-World War I European economists with laying the groundwork for modifications to the historical cost model. Eugen Schalenbach was an early proponent of using a general price index to stabilize the financial measuring unit. Fritz Schmidt, by contrast, rejected general price-level adjustments in favor of current replacement cost accounting. Theo Limberg, a Dutch practitioner (whose works, regrettably, unlike those of the others, have not been translated into English) developed the replacement cost system that was adopted by Phillips and a number of other Dutch firms. Henry Sweeney, in *Stabilized Accounting* (1936), which used to be required reading for most doctoral candidates, and which the authors characterize as "undoubtedly" the most important of the pre-World War II English language publications, wrote the standard text on general price level adjustments.

Tweedie and Whittington show how the development of standards in several English speaking countries, particularly the United States and Great Britain, has been remarkably similar. In both countries the accounting rule-making authorities initially favored constant purchasing power approaches by which historical-cost statements were adjusted by a general price level index. Government agencies, however, intervened with proposals for current cost accounting models in which individual assets were reported at replacement values. Then, following extensive debate, there evolved the hybrid proposals which have become the official standards.

In 1973 the British Accounting Standards Steering Committee recommended that stock exchange-listed companies be required to supplement conventional financial reports with constant purchasing power statements. Before the comment period on its exposure draft had expired, the Government pulled the rug from beneath the Committee. It established an independent authority, the Sandilands Committee, to deal with inflation accounting. The Government was motivated by demands both from industry, which objected to having to report lower profits, and from the Inland Revenue Commission, which feared that it would come under pressure to use the adjusted income as the basis for company taxation. The Sandilands Committee rejected the constant purchasing power approach proposed by the Accounting Standards Steering Committee in favor of a current cost system. Over the next seven years, the British accounting profession grappled with one compromise proposal after another. The result of its debates was a pronouncement that a majority of users have been able to live with but which provides information that is useful only to a minority.

In the United States, the Financial Accounting Standards Board issued, in 1974, an exposure draft favoring general price level adjustments. Its proposals, Tweedie and Whittington note, contributed no conceptual advances over ARS 6 and APB 3, which had been issued more than ten years earlier. The SEC rejected the FASB approach, announcing that it would require replacement cost disclosures. The FASB, like the Accounting Standards Steering Committee, was then forced to back away from its original position. After several years of discussion and study, it issued Statement 33, stipulating that both constant purchasing power and current cost accounting information be included in annual reports.

While *The Debate on Inflation Accounting* explains clearly the fundamental models, it is a history, not a tutorial. For detailed analyses of the models, readers are referred to a companion volume by Whittington, *Inflation Accounting, An Introduction to the Debate* (reviewed in this journal in January 1984).

The Debate on Inflation Accounting generally follows a chronological path of reporting, starting with the early 20th century. It branches in 1973 to deal separately with the American and the British experiences. It also has individual sections on the main competing systems of inflation accounting, and on issues (e.g., valuation of assets, maintenance of capital, and monetary gains and losses) common to all systems. This organizational structure results in considerable repetition of a number of main ideas, but the reader is compensated with differing perspectives on key issues.

The authors pay only passing attention to the Herculean accounting problems of Latin American countries. In light of inflation rates that reached as high as 504 percent (Chile, 1974), that is an unfortunate, if understandable, deficiency. The authors clearly intended to focus on the intellectual and professional experiences of the United States and Britain. They summarize events in other countries mainly to remind us that accounting is not limited only to those two countries.

Tweedie and Whittington hypothesize as to the factors that have controlled the direction of inflation accounting. They acknowledge that official pronouncements have been influenced to a considerable extent by the self-serving positions taken by governments, corporations, and other powerful parties. They are far less cynical toward the contribution of intellectual debate than are many academic accountants. They maintain, for example, that the "ideas" of accounting theorists, coupled with "a genuine desire to progress towards a more consistent and accurate method of inflation accounting," have also had a significant impact. At the very least, they have imposed limits on self-interest.

As Tweedie and Whittington demonstrate, the theory of inflation accounting was well established by the end of World War II. That is all the more reason why we should place this book on our shelves until the rate of inflation again reaches double digits. We can then resume the debate where it was discontinued, without once again rewriting more than a half-century of accounting literature.

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NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

EARL D. BENNETT, BARBARA M. FOSSUM, ROY D. HARRIS, DON ROBERTSON, and J. FRANKLIN SKIPPER, *Financial Practices in a Computer Integrated Systems Environment* (Morristown, New Jersey: Financial Executives Research Foundation, 1987, pp. vi, 59, $5.00 paper).

Six chapters discuss issues related to the growth in the use of computer integrated systems (CIS) in manufacturing and distribution functions and the impact of such use upon the financial executive's function. The book is based largely on the questionnaire responses of financial, manufacturing and distribution executives, and a Financial Executives Institute workshop. Among topics covered are: trends in the use of CIS and the implications of such use for financial executives; investment decisions related to the use of integrated computer services; interfaces with financial systems; and computer integration with manufacturing operations and distribution functions. Appendices include a glossary of computer integrated services terms and selected readings. Earl D. Bennett is Professor of Accounting at Texas A&M University; Barbara M. Fossum is Vice President of Technology Systems at Factorial Systems, Incorporated; Roy D. Harris is Professor and Director of the Manufacturing Systems Engineering Program at the University of Texas; Don Robertson is Vice President and Controller at Anderson Clayton & Company; and J. Franklin Skipper is Director of Computer Integration at Mantech Services Corporation.

ROBERT CAPETTINI and DONALD K. CLANCY, Editors, *Cost Accounting, Robotics, and the New Manufacturing Environment* (Sarasota, Florida: American Accounting Association, 1987, paginated by section, $5.00 paper).

Book contains edited presentations from the First Annual Management Accounting Symposium, held at the Owen Graduate School of Management, Vanderbilt University, on February 26–28, 1987, which was co-chaired by William Ferrara and James Bulloch. Volume is a joint publication of the American Accounting Association, Management Accounting Section and the National Association of Accountants, Committee on Academic Relations. Presentations include: Joseph D. Blackburn, Professor of Operations Management, the Owen Graduate School of

Management, Vanderbilt University, "Trends in Manufacturing"; Robert A. Howell, Professor of Management and Accounting at the Graduate School of Business Administration, New York University, "World Class Manufacturing Controls: Management Accounting for the Factory of the Future"; Robert H. Kelder, Manager, Cost Accounting Competency Center, CHQ, IBM Corporation, "Era of Cost Accounting Changes"; William G. Holbrook, Vice President of Administration for Stanadyne Automotive Products Group, "Accounting Experiences in a JIT Environment"; James A. Brimson, Vice President for Business Development, Computer Aided Manufacturing-International, Inc., "CAM-I Cost Management Systems Project"; Leonard Frescoln, Vice President and Controller, Williams International, "The CAM-I Cost Accounting Model and Cost Accounting at Williams International"; Robert S. Kaplan, Arthur Lowes Dickinson Professor of Accounting, Harvard University and Professor of Industrial Administration, Carnegie Mellon University, "Regaining Relevance"; Robert D'Amore, Manager, Coopers & Lybrand, "Just-in-Time Systems"; and Gordon Shillinglaw, Professor of Accounting, Columbia University, "Looking Back from the Future." Robert Capettini is Professor, School of Accountancy, San Diego State University, and Donald K. Clancy is Professor, College of Business Administration, Texas Tech University.

Editor's Note: Book can be obtained from Donald K. Clancy, College of Business Administration, Texas Tech University, Lubbock, Texas 79409-4320 (checks should be payable to "The Management Accounting Section AAA").

CLARK E. CHASTAIN, *Corporate Asset Management: A Guide for Financial and Accounting Professionals* (New York; Westport, Connecticut; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. xxiii, 344, $49.95).

Text covers traditional aspects of corporate asset management as well as the subjects of mergers, acquisitions, and divestitures viewed from the standpoints of finance, management, accounting, and taxation. Topics discussed in the book's 16 chapters include profitability, risk analysis, working capital management, cash management, management of marketable securities, administration of accounts receivable and credit policies, inventory management, capital budgeting, and the cost of capital.

Intended for use by financial and accounting professionals and students of corporate finance for that part of a course which considers the asset side of the balance sheet. Clark E. Chastain is Professor of Accounting at the University of Michigan-Flint.

JAMES W. DEAN, JR., *Deciding to Innovate: How Firms Justify Advanced Technology* (Cambridge, Massachusetts: Ballinger Publishing Company, a Subsidiary of Harper & Row, Publishers, Inc., 1987, pp. 184, $29.95).

In ten chapters, author examines the decision-making process of manufacturing firms regarding the adoption of technological innovations, using data gathered from five manufacturing companies. While use of new technology provides a competitive edge, two qualifications to such use are stated: 1) once the decision to use a new technology is made, the technology must be successfully implemented; and 2) use of technology must be combined with effective management. Part One looks at the competitive environment for manufacturing, the potential benefits of technological developments for American manufacturers and the means by which such use is justified, as well as the findings of other researchers of the decision process and an overview of the study at hand. Part Two presents case studies of the five manufacturing firms. Part Three evaluates the findings of the case studies in the form of a model, discusses the implications of these findings for research and management, compares the current findings with those of prior studies on innovation decisions, and lists recommendations for managers on how to use the justification process in order to facilitate the adoption of new technology. James W. Dean, Jr., is Assistant Professor of Organizational Behavior in the College of Business Administration at The Pennsylvania State University.

DELOITTE HASKINS & SELLS and FINANCIAL EXECUTIVES RESEARCH FOUNDATION, *Summary Annual Reports: A New Option to Improve Shareholder Communications* (New York: Deloitte Haskins & Sells, 1987, pp. 48, no charge-paper).

Booklet describes the new option of summary annual reporting as a means to improve communication between public companies and their shareholders. Summary annual reports are designed to present financial information to shareholders in a more accessible and readable format than traditional annual reports. Proxy materials, which are also sent to the shareholder to comply with the Security and Exchange Commission's (SEC) disclosure requirements, include full audited statements and other required disclosure materials. Also discussed are a 1983 research study conducted by Deloitte Haskins & Sells (DHS), sponsored by the Financial Executives Research Foundation (FERF), as well as more recent FERF sponsored studies and a study conducted by the Financial Executives Institute, the SEC, and the Financial Reporting Institute, University of Southern California. In addition, this work considers current SEC regulatory requirements regarding financial disclosure; a proposal by the General Motors Company to the SEC in 1986 to use the summary report; actual use of such a report by the McKesson Corporation in 1987; and guidelines for preparing a summary annual report. A questions and answers section addresses the issue of cost savings; the General Motors proposal to the SEC; preparation of the summary report; and SEC requirements. Four appendices include a list of participants in the 1983 DHS study; the minimum disclosure guidelines from this study; correspondence between the General Motors Corporation and the SEC staff; and correspondence between the McKesson Corporation and the SEC staff.

DAVID P. DOANE, *Exploring Statistics with the IBM PC*, Second Edition (Reading, Massachusetts; Menlo Park, California; New York; Don Mills, Ontario; Workingham, England; Amsterdam; Bonn; Sydney; Singapore; Tokyo; Madrid; Bogota; Santiago; and San Juan: Addison-Wesley Publishing Company, 1987, pp. xv, 302, $44.25 paper-includes diskettes).

Manual and accompanying program and data diskettes for a basic statistical package containing 24 routines including descriptive analysis, transformations, discrete and continuous probability distributions, tests of independence and goodness of fit, two sample tests, simple and multiple regression, and others. The package is menu-driven with file, program, and help menus. A separate file is needed for each variable. The package is very easy to learn and to use and the various statistical programs provide basic output. Site licenses are available. David P. Doane is Professor and Chairman of the Department of Management Information Systems and Quantitative Methods at Oakland University.

ERNST & WHINNEY, *Combating Fraud* (London: The Institute of Chartered Accountants in England and Wales, 1987, pp. 62, £5.95).

Purpose is to assist directors and managers in the task of assessing the likelihood of fraud and minimizing it within their organizations. Emphasis is placed on the role of management in preventing and detecting fraud and steps for action if fraud is suspected are suggested. Checklists on warning signs and key indicators of fraud, as well as use of controls (general and computer), provide practical guidance. Book is part of a video training package, "Danger! Fraud at Work," produced by The Institute of Chartered Accountants in England and Wales.

FINANCIAL EXECUTIVES RESEARCH FOUNDATION, *Investor Information Needs and the Annual Report* (Morristown, New Jersey: Financial Executives Research Foundation, 1987, pp. viii, 101, $15.00 paper).

Study conducted by SRI International and sponsored by Financial Executives Research Foundation is intended to further understanding of the information needs of corporate investors and the annual report as a means by which such information is provided. Eight chapters discuss and define the professional and the individual investor and the perceptions and information needs of both; the corporate perspective regarding the dissemination of information and use of the annual report; investor perceptions of and uses for the annual report; and improvements for the annual report. Appendices include: the research methodology employed in conducting the study; the telephone questionnaires for individual and professional investors; and a corporate executives interview guide.

LORETTA GRAZIANO, *Interpreting the Money Supply: Human and Institutional Factors* (New York; Westport, Connecticut; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. xiii, 245, $45.00).

A study which examines the human cognitive processes of information processing as applicable to data regarding the money supply and related economic outcomes. The author uses tools of cognitive psychology, neurophysiology, and psycho-linguistics to evaluate human information processing as applicable to monetary analysis. Part One is introductory and discusses the means by which external events are encoded into data and then decoded into cognitive representations of external events. Part Two examines the brain's method of decoding data and creating information. Four pitfalls of human cognitive processes are identified. Part Three looks at the process of encoding of economic data, as performed within institutions. Encoders, interested in promoting the survival of the institutions in which they work, comply with the decoder's wishes and present "cognitively convenient data." The data of the encoders is in a sense biased. Part Four points out cognitive pitfalls in the process of evaluating money supply data and its relationship with other economic indicators, in particular, interest rates and inflation. An earlier book by Loretta Graziano, *Currency Fluctuations and the Perception of Corporate Performance*, was reviewed in the October 1987 issue of THE ACCOUNTING REVIEW. Loretta Graziano is Associate Professor of Management Sciences in the School of Business and Economics, California State University-Hayward.

DAVID F. HEATHFIELD and SOREN WIBE, *An Introduction to Cost and Production Functions* (Atlantic Highlands, New Jersey: Humanities Press, Inc., 1987, pp. xv, 193, $9.95 paper, $35.00 cloth).

Nine chapters focus on neoclassical approaches to production. When appropriate, cost functions are presented with their associated production functions. Topics discussed include: an introduction to production and production functions; cost functions and the theory of the firm; elasticity, efficiency, and the theory of the firm; the Cobb-Douglas Function; the CES Function; the Translog Function; technological progress; the Johansen Production Model and empirical work on production functions. David F. Heathfield is Senior Lecturer in Economics at the University of Southampton. Soren Wibe is Professor of Economics in the Department of Forest Economics, University of Umea, Sweden.

BRIAN MOORES, Editor, *Are They Being Served? Quality Consciousness in Service Industries* (Atlantic Highlands, New Jersey: Humanities Press, Inc., 1986, pp. 305, $19.95 paper, $50.00 cloth).

Collection of essays on the subject of customer satisfaction and the role it plays in both public and private organizations in the United Kingdom. Papers are given on a variety of topics: "Quality Considerations"—Ron Mortiboys, "Quality in the Boardroom"; Frank Price, "How Does Britain Rate on Quality?"; Barrie Dale, "Experience with Quality Circles and Quality Costs"; and Chris Lane, "Putting People First—A Company-Wide Approach to Good Service." "Travel"—Daniel Giblin, "Customer Care in British Rail"; Carolyn Evans, "Airline Performance as Rated By Frequent Passengers"; Brian Hamill and Roger Davies, "Quality in British Airways." "Health"—Andy Thompson, "What the Patient Thinks"; David Bowden, Glen Williams, and Geoff Stevens, "Medical Quality Assurance in Brighton Health Authority —Can American Translate into English?"; Peter Horrocks, "The Approach of the NHS Health Advisory Service in England and Wales"; Len Goldstone and Veronica Illsley, "Measuring the Quality of Nursing Care—The Monitor Experience." "Retailing"—David Buswell, "The Development of a Quality Measurement System for a UK Bank"; Owen Thomas, "Ensuring Quality of Service for Sainsbury's Customers"; and Tim Burfoot, "Quality Control in Thomas Cook." "Hospitality"—Mia Touzin, "The Sheraton Guest Experience"; Jeremy Round, "The Good Food Guide"; Barbara Lewis and Mike Owtram, "Customer Satisfaction with Package Holidays." "Watchdogs"—John Winward, "Nationalised Industry Consumer Councils"; Tony Smythe and Judith Cook, "Community Health Councils"; and Michael Warren, "Consumers' Association: Which? Why and How." "Information"—Peter Menneer, "Broadcasting Research—Necessity or Nicety?"; Merlin Stone, "Keeping Customers by Keeping Them Happy—An Example from the Computer Industry"; and David Yorke, "The Quality of Library Services." An Introduction and Epilogue are written by the Editor.

Brian Moores is Professor of Management at the Cardiff Business School, University of Wales Institute of Science and Technology.

LOUIS E. V. NEVAER and STEVEN A. DECK, *Corporate Financial Planning and Management in a Deficit Economy* (New York; Westport, Connecticut; and London: Quorum Books, a Division of

Greenwood Press, Inc., 1987, pp. xv, 172, $37.95).

Thirteen chapters describe the "deficit economy" prevailing since 1979, which, according to the authors, most likely will be present until the end of this century. Discussion centers on the consequences of such an economy and of government fiscal and monetary policy for corporate finance and management. Part I concerns the deficit economy and presents an overview of post-World War II economic history in terms of "the Bretton Woods and Oil Shock Economies." Structural deficits (those which occur when the economy is operating at full employment) are defined and the implications of the present administration's fiscal and monetary policies are considered. Part II deals with financial planning and management and first discusses the concerns of corporate officers who are directly affected by economic developments, including corporate debt policy; cash management; financial flexibility; pension fund management; and project financing. Next considered are the implications of the deficit economy for the global issues of corporate taxes, interest rates, the international arena, and the domestic business cycle. Part III reviews possible changes in government fiscal, monetary, and tax policy, and examines the possibility of debt repudiation through inflation and the long-term problems associated with servicing public debt. The authors argue for the retirement of $500 billion in public debt as well as the need for government budget surpluses. Louis E. V. Nevaer is Director of Political Analysis and Steven A. Deck is Executive Director of Data and Statistics at International Credit Monitor.

DAVID ROSS, *Employment Abroad: A Guide to the Tax Problems*, Third Edition (London: The Institute of Chartered Accountants in England and Wales, 1987, pp. 84, £5.50).

Eight chapters consider the tax problems faced by the British executive on assignment in a foreign country. Focus is on the United Kingdom tax implications, but tax systems of selected other countries including Australia, Canada, France, Japan, the Middle East, The Netherlands, and the U.S., are briefly considered. Two appendices include a list of countries with which the U.K. has concluded double taxation agreements and a list of tax exempt securities issued by the British Treasury. David Ross is with Price Waterhouse.

Standard Setting for Financial Reporting: An International Conference Sponsored by the American Accounting Association with Klynveld Main Goerdeler, August 17-20, 1986 (Montvale, New Jersey: Peat Marwick Main & Co., 1987, pp. iii, 140, available at no charge from Peat Marwick Main & Co., 3 Chestnut Ridge Road, Montvale, New Jersey-paper).

Proceedings of the American Accounting Association-Klynveld Main Goerdeler Conference on Standard Setting for Financial Reporting, held at the Henry Chauncey Conference Center, Princeton, New Jersey, from August 17-20, 1986. The conference, which was chaired and coordinated by David Solomons, included participants from 23 countries and five international organizations. Its objective was to provide a means by which those involved in standard setting might exchange information, with the goal of making standard setting arrangements more effective.

The Foreword was written by Stephen A. Zeff, the originator of the conference. David Solomons wrote the Introduction which summarizes each of the conference's six topics. The opening address was delivered by John L. Kirkpatrick. The format called for plenary sessions, followed by group discussions, on the first four topics. Papers under the topic of "The Objectives of Financial Reporting" include: Robert N. Anthony, "A User's Viewpoint"; Robert C. Spinosa Cattela, "A Preparer's Viewpoint"; and M. Ayo Oni, "The Viewpoint of a Developing Country." Papers on the subject of "Institutional Arrangements for Setting Standards" are: Robert T. Sprouse, "The United States"; Seigo Nakajima, "Japan"; and Brian Morley and Carrick A. Martin, "Australia." Three participants —Arthur R. Wyatt, Kevin M. Stevenson, and John H. Denman—addressed "The Role of a Conceptual Framework." Two papers were presented on the topic of "Accounting for Inflation": Geoffrey Whittington, "Accounting and Changing Prices" and Eliseu Martins, "Accounting for Inflation in a Hyperinflationary Economy." Michael Renshall discussed "The Economics and Politics of Standard Setting." William H. Beaver, Baruch Lev, and Leandro Canibano Calvo spoke on "The Contribution of Research to Standard Setting." On the topic of "The Harmonization of Accounting Standards," three papers were presented: David H. Cairns, "The Role and Achievements of the International Accounting Standards Committee"; Karel Van

Hulle, "The EEC's Experience of Harmonization in Light of the Fourth Directive"; and Kamal Gupta, "The Indian Experience."

CHARLS E. WALKER and MARK A. BLOOMFIELD, Editors, *The Consumption Tax: A Better Alternative?* (Cambridge, Massachusetts: Ballinger Publishing Company, a Subsidiary of Harper & Row, Publishers, Inc., 1987, pp. 400, $35.00).

Volume includes revised versions of papers presented at a conference of the same title sponsored by the American Council for Capital Formation Center for Policy Research, held in Washington, D.C. in September, 1986. Papers discuss the various implications of a consumption tax, including the impact of such a tax on saving, investment, economic growth, international trade, and revenue raising. Essays are grouped into two topics: 1) Political and Economic Perspectives on a U.S. Consumption Tax and 2) A U.S. Consumption Tax: Possibilities and Problems. Conference participants included: Henry J. Aaron; Harvey E. Bale, Jr.; J. Gregory Ballentine; Max Baucus; Stephen E. Bell; David F. Bradford; George N. Carlson; Milka Casanegra de Jantscher; Ernest S. Christian, Jr.; Edwin S. Cohen; Dave Durenberger; Ronnie G. Flippo; Henry H. Fowler; Bill Gradison; Gary Hufbauer; Robert Kuttner; Bruce K. MacLaury; John H. Makin; Robert T. Matsui; Charles E. McLure, Jr.; Charles W. Parry; Joseph A. Pechman; Rudolph G. Penner; Kevin P. Phillips; Joel L. Prakken; Dan Rostenkowski; Dick Schulze; John B. Shoven; J. A. Stockfisch; Lawrence H. Summers; Thomas E. Vasquez; George F. Will; and Michael H. Wilson. Charls E. Walker is voluntary chairman of the American Council for Capital Formation and the American Council for Capital Formation Center for Policy Research and chairman of Charls E. Walker Associates, Inc. Mark A. Bloomfield is president of the American Council for Capital Formation and the American Council for Capital Formation Center for Policy Research.

Editor's Note: Catherine McNally assisted the Editor in annotating these books.

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JOAN LORDI AMBLE and JULES M. CASSEL, *A Guide to Implementation of Statement 88 on Employers' Accounting for Settlements and Curtailments of Defined Benefit Pension Plans and for Termination Benefits: Questions and Answers*, Special Report (Stamford, Connecticut: Financial Accounting Standards Board, 1988, pp. vii, 73, $20.00 paper).

A. A. ATKINSON, *Intra-firm Cost and Resource Allocations: Theory and Practice*, Studies in Canadian Accounting Research (Toronto: The Canadian Academic Accounting Association, 1987, pp. 201, Can. $25.00 paper).

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JAMES W. DEAN, JR., *Deciding to Innovate: How Firms Justify Advanced Technology* (Cambridge, Massachusetts: Ballinger Publishing Company, a Subsidiary of Harper & Row, Publishers, Inc., 1987, pp. 184, $29.95).

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STEPHEN M. STIGLER, *The History of Statistics: The Measurement of Uncertainty Before 1900* (Cambridge, Massachusetts and London, England: The Belknap Press of Harvard University Press, 1986, pp. xvi, 410, $25.00).

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FELLOWSHIP AWARD WINNERS

The American Accounting Association's Student Fellowship Committee met in Newport Beach on April 14, 1988 to select the 1988-89 recipients of the American Accounting Association grants. The committee was chaired by John M. Hassell, Florida State University, Talmadge C. Tillman, Jr., California State University at Long Beach, and Philip H. Siegel, San Francisco State University. The Fellowship Committee was authorized to grant $5,000 awards for 1988-89 to outstanding applicants based only upon academic merits. The committee selections were based upon the applicants' attributes and accomplishments and were made without distinction as to the school at which the applicant would pursue the doctoral studies. The committee reviewed fifty applications and granted ten awards of $5,000 each. The Fellowship Award winners were:

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Maureen P. Breen
David Martin Bukovinsky
Gregory A. Carnes
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* Monographs Number 1, 2, 4, and 7 are out of print.

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THE ACCOUNTING REVIEW
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Analysts' Forecasts, Earnings Variability, and Option Pricing: Empirical Evidence

Lane A. Daley, David W. Senkow,
and Robert L. Vigeland

ABSTRACT: This study investigates empirical relations that are consistent with the hypothesis that variance in analysts' forecasts of earnings (i.e., disagreement among analysts) is useful as an *ex ante* measure of the market's aggregate uncertainty regarding a future earnings signal. We hypothesize and test for a positive association between the variance of analysts' forecasts and (1) the *ex post* magnitude of unexpected earnings, (2) the *ex post* variance of returns around the actual earnings announcement date, and (3) the average variance of return to maturity implied by prices of options maturing after the earnings announcement date. Our results generally confirm that the disagreement among analysts' earnings forecasts is a useful indicator of the market's aggregrate uncertainty regarding future earnings announcements.

THIS study provides evidence consistent with the hypothesis that cross-sectional variance of analysts' forecasts of annual earnings is useful as an *ex ante* measure of the market's uncertainty about the future earnings signal. The paper develops and tests predictions of a positive association between the cross-sectional variance of analysts' forecasts of earnings and three other measures: (1) the *ex post* magnitude of unexpected earnings, (2) the *ex post* variance of returns around the date of the actual earnings announcement, and (3) the average variance of return to maturity implied by prices of options maturing after the earnings announcement date.

The theory and evidence presented contribute to the understanding of the usefulness of analysts' forecasts by focusing on the variance of earnings forecasts (i.e., the disagreement among analysts). There is substantial evidence that suggests that analysts' forecasts possess information (see Imhoff and Lobo [1984] for one example). This liter-

Financial support for this research from the McKnight Foundation, the University of Minnesota Graduate School Faculty Summer Research Fellowships Program, School of Management, and Accounting Research Center is gratefully acknowledged. Earlier versions of this paper were presented at the University of Chicago, the University of Minnesota, and the 1985 American Accounting Association Annual Meeting. Helpful comments were also received from Dan Collins, S. P. Kothari, Judy Rayburn and, especially, Jerry Salamon.

Lane A. Daley, David W. Senkow, and Robert L. Vigeland, University of Minnesota.

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ature has documented that the release of an analyst's forecast is, on average, accompanied by a stock price movement that is consistent with the direction of the revision in the earnings expectation. Much of the existing research has tended to regard the latest analyst's forecast (or the consensus forecast) as a sufficient statistic for all the information analysts have regarding earnings. The approach taken here is to examine the role of the cross-sectional variance of the distribution of earnings forecasts, i.e., whether the set of all currently available forecasts contains information.

The results of this paper corroborate and extend those of Patell and Wolfson [1979, 1981] who found that the periods in which annual or quarterly earnings are announced are anticipated to be periods of increased stock price variability. They used the option pricing model of Black and Scholes [1973] to derive a prediction about the pattern of the implied stock price variance over the life of the option. Their approach takes the Black and Scholes model as a maintained hypothesis and infers the implied variance given observed option prices and stock prices. At one point in their analysis, Patell and Wolfson develop a representation of the variance of stock returns as a sum of a normal variance (variance during nonevent periods) plus the added return variance that is due to the announcement of earnings. However, Patell and Wolfson did not provide direct evidence about how the added return variance is related to the variance of the earnings signal.

The model used here adds to the structure of the Patell and Wolfson model by explicitly linking the variance of the earnings signal with the variance of stock returns. We hypothesize that the variance of analysts' forecasts of earnings is useful as an *ex ante* measure of the variance of the future earnings signal. This leads to the prediction that the variance of analysts' forecasts of earnings should be significantly related to the implied variance of return to maturity for those options maturing after the earnings announcement date.

Our tests of the association between the variance of analysts' forecasts and the average variance of return to maturity implied by option prices are similar to a test conducted by Ajinkya and Gift [1985]. Ajinkya and Gift assessed the correlation between the implied standard deviation (ISD) of stock returns and the standard deviation of analysts' forecasts in order to explain Chiras and Manaster's [1978] finding that "for predicting *future* actual time series standard deviations (FSDs) of stock returns, the ISDs were superior predictors relative to using historic (past) time series standard deviations (HSDs)" [p. 1353]. Ajinkya and Gift found that the standard deviation of analysts' forecasts was significantly related to the implied average variance of return to maturity.

Our tests of association between the variance of analysts' forecasts and the average variance of return to maturity implied by option prices differ from Ajinkya and Gift's related test because our tests control for differences in option maturity dates. Ajinkya and Gift included options in their sample that matured both before and after the earnings announcement dates. The theory predicts a significant association only for those options maturing after earnings announcements. The separate testing of the relations on options maturing before and after earnings announcements is theoretically a more appropriate examination of the association between the variance of analysts' forecasts and the average variance of return to maturity implied by option prices than the Ajinkya and Gift test.

Results of the study indicate a positive and significant association between the variance of analysts' forecasts of annual earnings and (1) the *ex post* magnitude of unexpected earnings and (2) the average variance of return to maturity implied by prices of options maturing after the earnings announcement date (after controlling for the normal variance of returns). Furthermore, the tests of the association between the variance of analysts' forecasts and the average variance of return to maturity implied by prices of options maturing prior to the earnings release dates do not demonstrate a statistically significant relation.

Contrary to the predictions of our theory, the association between the variance of analysts' forecasts and the *ex post* variance of returns in earnings announcement periods did not demonstrate a significant positive association. This result suggests that the variance of analysts' forecasts may capture factors other than the *ex post* magnitude of unexpected earnings and that these other factors condition the reaction of stock prices to earnings announcements.

The remainder of the paper is organized as follows. Section I motivates and develops the four hypotheses of the paper. Much of Section I is based upon a model that draws heavily on Patell and Wolfson's work along with many of the studies of the association between stock returns and earnings releases. Section II discusses empirical testing and measurement of variables. Results are contained in Section III, and the paper closes with a summary in Section IV.

I. THEORETICAL DEVELOPMENT AND STATEMENT OF HYPOTHESES

Numerous studies, starting with Ball and Brown [1968], have documented a relation between *ex post* unexpected earnings and *ex post* unexpected stock returns. More recently, Patell and Wolfson [1979, 1981] have conducted tests based on option prices to assess the *ex ante* effects of earnings announcements. They report that periods in which earnings announcements are expected to be released are anticipated to be periods of increased stock price variability. Taken together, these findings suggest that the anticipated increased stock price variability during earnings announcement periods is due to the underlying variability of the future earnings signal.

This study explores the role of analysts' forecasts of earnings (in particular, the variation across analysts' forecasts) as a potential source of information about the market's aggregate belief regarding the distribution of the future earnings signal. In the first subsection we argue that if the variance of analysts' forecasts captures information about the distribution of future earnings signals, then there should be an association between the variance of analysts' forecasts and the magnitude of *ex post* unexpected earnings. The second subsection extends this analysis to develop a hypothesis of an association between the variance of analysts' forecasts and the *ex post* variance of stock returns in the period surrounding an earnings release. The third subsection integrates previous research on the *ex post* relation between unexpected returns and unexpected earnings with Patell and Wolfson's application of the option pricing model (OPM) to motivate a hypothesis regarding an association between the variance of analysts' forecasts of earnings and the *ex ante* implied average variance of return to maturity.

Analysts' Forecasts and the Distribution of Earnings

Suppose each firm's distribution of earnings is conditional on a vector of information variables. Each analyst's forecast can be viewed as a drawing from the distribution of information variables that produces an estimate of the expected value of earnings conditional on a particular realization of the information vector. Different analysts' forecasts can be viewed as estimates of the expected value of earnings conditional on potentially different realizations (or interpretations) of the information variables. If the set of analysts' forecasts captures information about the underlying distribution of earnings, then, *ceteris paribus*, as the variance in the unconditional distribution of earnings increases, the variance of analysts' estimates of the conditional expected value of earnings will also increase.

This hypothesized association between the variance of the distribution of earnings and the variance of analysts' forecasts is difficult to test directly. Since only one realization from each distribution of annual earnings is available each year, it is not possible to estimate the variance of the distribution from *ex post* observations. However, as the variance of the distribution of earnings increases, the probability of observing "large" deviations from the mean will also increase. This implies an association between the variance of analysts' forecasts and the magnitude of *ex post* deviations from expected earnings, where expected earnings are estimated by the mean of the distribution of analysts' forecasts. These *ex post* deviations from expected earnings are commonly referred to as "unexpected earnings," a term used hereafter in this paper. Thus, the first testable hypothesis, stated in the alternative form, is as follows:

> H1: There is a positive association between the variance of analysts' forecasts and the magnitude of unexpected earnings.

Analysts' Forecasts and the Ex Post *Distribution of Stock Returns*

Suppose firm *i* announces its annual earnings in period t^*. Consider the following *ex post* model of the relation between the return on the stock of firm *i* in period *t* (R_{it}), the return on the market portfolio in period *t* (R_{mt}), and a standardized measure of the market's assessment of the unexpected earnings for firm *i* (UE_{it}):

$$R_{it}=\alpha_i+\beta_i R_{mt}+\gamma UE_{it}+\theta_{it} \qquad (1)$$

where

$$UE_{it}=0 \ \forall \ t\neq t^*.$$

Equation (1) is a generalized form of the familiar market model with an additional term to allow for the effects of an earnings release in period t^*. This generalized return model is similar to that used by Schipper and Thompson [1983].

In equation (1), the coefficient of UE_{it}, γ, is assumed to be a cross-sectional and cross-temporal constant. This assumption is implicit in much of the research between unexpected earnings and unexpected returns (e.g., Biddle and Lindahl [1982]).[1] This assumption of the model requires the use of a standardized measure of unexpected earnings and the one used here is unexpected earnings (actual earnings minus expected earnings) divided by expected earnings.

The *ex post* variance of stock returns during earnings announcement periods

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[1] Biddle and Lindahl [1982] estimated the following model cross-sectionally to test for a stock price reaction to firms' adoption of the LIFO inventory method:

$$R_t-E(R_t)=\lambda_0+\lambda_1 UE_t+\ldots+\theta_t$$

The missing terms relate to the hypothesized effects of LIFO adoption. Biddle and Lindahl used the same measure of standardized unexpected earnings as that used here: unexpected earnings (realized earnings minus expected earnings) divided by expected earnings.

(denoted σ_e^2) can be derived from equation (1) as:

$$\sigma_e^2=\beta_i^2\sigma^2(R_m)+\gamma^2\sigma^2(UE_i)+\sigma^2(\theta_i). \quad (2)$$

The sum of the first and last terms on the right hand side of equation (2) can be thought of as the normal variance of returns in non-announcement periods and the second term represents the additional variance contributed by the earnings signal. If we label this normal variance as σ_n^2, equation (2) can be rewritten as:

$$\sigma_e^2=\sigma_n^2+\gamma^2\sigma^2(UE_i) \quad (3)$$

Expression (3) posits a positive association between the *ex post* variance of returns during an earnings announcement period, σ_e^2, and the variance of unexpected earnings, $\sigma^2(UE_i)$. If the variance of analysts' forecasts captures information about the variance of the distribution of earnings (and, therefore, unexpected earnings), then there will be a positive association between the *ex post* variance of returns during earnings announcement periods and the variance of analysts' forecasts. This leads to the second hypothesis of this study, which can be stated in the alternative form as follows:

H2: There is a positive association between the variance of analysts' forecasts and the *ex post* variance of stock returns in the period of an earnings release.

Substitution of the variance of analysts' forecasts for the *ex post* variance of unexpected earnings in equation (3) leads to the prediction of an association between the *ex post* variance of stock returns during an earnings announcement period and the variance of analysts' forecasts. Since a standardized measure of unexpected earnings is used in equation (3), it is necessary to use standardized analysts' forecasts in the empirical tests. We therefore scale each analyst's forecast of a firm's earnings by the mean of all analysts' forecasts before estimating the variance. The basic structure of the cross-sectional model to test H2 can be written (with firm subscripts dropped for convenience) as follows:

$$\sigma_e^2=\delta_0+\delta_1\sigma_n^2+\delta_2\sigma_f^2+\epsilon_t \quad (4)$$

where, for a particular firm,

σ_e^2 = the variance of returns during an earnings announcement period,
σ_n^2 = the normal variance of returns,
σ_f^2 = the variance of analysts' forecasts, and
ϵ_t = the random error term, assumed to be normally distributed with mean = 0 and variance = σ_ϵ^2.

A test of H2 can be accomplished by estimating equation (4) cross-sectionally and testing the significance of δ_2.

Analysts' Forecasts and the Ex Ante *Distribution of Stock Returns*

It is possible to directly examine the *ex ante* relation between the variance of analysts' forecasts and the variance of return in the earnings announcement period. Following Patell and Wolfson, the *ex ante* measure of the expected increase in the variance of return during the future earnings announcement period is inferred from the prices of call options which mature *after* the earnings announcement. To carry out their tests, Patell and Wolfson [1981] used the Black and Scholes [1973] option pricing model to estimate the instantaneous *ex ante* variance of returns.[2] The same approach is taken here. The Black and

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[2] Empirical tests of the option pricing model have been conducted by Latané and Rendleman [1976], Schmalensee and Trippi [1978], and Macbeth and Merville [1979] among others.

Scholes model of the price of a call option is:

$$C = SN(d_1) - Xe^{-rT}N(d_2) \qquad (5)$$

where

$$d_1 = \frac{\ell n(S/X) + (r + .5\sigma^2)T}{\sigma\sqrt{T}},$$

$d_2 = d_1 - \sigma\sqrt{T}$,
X = current price of the underlying stock,
C = value of the call option,
S = exercise ("striking") price of the option,
T = time to maturity of the option,
r = continuous risk-free rate of interest per period,
σ = standard deviation of continuous returns on the underlying stock per unit time, and
$N()$ = cumulative standard normal distribution function.

All variables in the option pricing model are observable except for σ, the standard deviation of returns. It is possible to solve equation (5) by numerical methods to derive the instantaneous standard deviation of return implied by the current call option price, stock price, striking price, risk-free rate, and time to maturity of the option.

The model implicitly assumes that the variance of returns is constant over time which is obviously inconsistent with the intent of this study. However, Merton [1973] has shown that when the variance is changing over time, model (5) still holds but the variance must be interpreted as the average variance to maturity. This average variance can be written as:

$$\sigma^2(T) = T^{-1}\int_0^T \sigma^2(t)dt \qquad (6)$$

where

$\sigma^2(t)$ = variance of return to the underlying stock at time t.

The Patell and Wolfson [1981] model assumes that an earnings announcement occurs at time (t^*) and the information contained in the announcement is fully impounded in the stock price by time (t^*+1). The model also assumes that the variance of returns is constant at some "normal" level (σ_n^2) in all periods except the period of earnings release when it increases by some amount (σ_a^2). That is:

$$\sigma^2(t) = \sigma_n^2 \;\forall\; t < t^*,\; t > t^*+1, \text{ and} \qquad (7)$$

$$\sigma^2(t) = \sigma_n^2 + \sigma_a^2 \;\forall\; t^* < t < t^*+1 \qquad (8)$$

In this setting, $\sigma^2(T)$, the average variance of return to time T where $T > t^*+1$, i.e., when the earnings announcement occurs before time T, can be derived as:

$$\sigma^2(T) = T^{-1}\left\{\int_0^{t^*} \sigma_n^2 dt + \int_{t^*}^{t^*+1} (\sigma_n^2 + \sigma_a^2)dt + \int_{t^*+1}^{T} \sigma_n^2 dt\right\} \qquad (9)$$

Carrying out the indicated integration yields:

$$\sigma^2(T) = \frac{T\sigma_n^2 + \sigma_a^2}{T} = \sigma_n^2 + \sigma_a^2/T \qquad (10)$$

Likewise, the average variance of return to time T where $T < t^*+1$, i.e., when the earnings announcement occurs after time T, is simply:

$$\sigma^2(T) = \sigma_n^2 \qquad (10a)$$

Patell and Wolfson note that an implication of equation (10) (which is equivalent to equation (5) in Patell and Wolfson [1981, p. 441]) is that the average variance to maturity will gradually increase up to the event date and then fall back to the normal level once the event date is past. They observe the hypothesized pattern of implied standard deviations of returns in the period surrounding earnings announcements and conclude that the pattern is consistent with the anticipation of higher variability of returns around the date of the earnings release.

Together, equations (3) and (8) allow development of a link between the variance of analysts' forecasts with the additional variance anticipated in the earnings announcement period, σ_a^2. In particular, given these equations, it is expected that rational investors will anticipate that the magnitude of the anticipated increase in the variance of stock return during the period of the earnings announcement will be related to $\sigma^2(UE_i)$. This suggests that equation (10) can be rewritten as:

$$\sigma^2(T)=\sigma_n^2+\varphi\gamma^2\sigma^2(UE_i)/T \quad (11)$$

where

φ = the scalar that relates the *ex post* measure of variance of returns induced by the earnings announcement to its *ex ante* anticipation.

Expression (11) posits a positive association between the average variance of return to time T, $\sigma^2(T)$, and the *ex ante* variance of unexpected earnings for earnings announcements occurring before T.

If the variance of analysts' forecasts is associated with the *ex ante* variance of unexpected earnings, then equation (11) leads to the third hypothesis to be tested, which can be stated in its alternative form as:

H3: The variance in analysts' forecasts of earnings for a firm is positively related to the average variance of return to maturity implied by prices of call options maturing *after* the earnings announcement.

Equation (10a) indicates the average variance of return to time T when $T<t^*$ (i.e., when maturity occurs before the earnings announcement) is simply the normal variance of return. This implies that for options maturing prior to earnings announcements, the average variance of return to maturity should not be associated with measures of the variability of the earnings signal. This implication permits an internal validity check on the predictions of the model that is stated as the fourth hypothesis of the study, as follows:

H4: The variance in analysts' forecasts of earnings for a firm is unrelated to the average variance of return to maturity implied by prices of call options which mature *before* the earnings announcement date.

To test hypotheses H3 and H4, a cross-sectional regression approach is used to estimate a variant of equation (11) over a number of firms. This approach was chosen due to the small number of time series observations that are available. This issue is discussed more completely in Section II. The basic structure of the econometric model used to test H3 and H4 can be written (with firm subscripts dropped for convenience) as:

$$\sigma^2(T)=\delta_0+\delta_1\sigma_n^2+\delta_2(\sigma_f^2/T)+\epsilon \quad (12)$$

where, for a particular firm,

$\sigma^2(T)$ = the average variance of return to maturity implied by options maturing in T periods,

σ_n^2 = the normal variance of returns,
σ_f^2 = the variance of analysts' forecasts of the earnings signal scaled by expected earnings,
T = the time to maturity of the options, and
ϵ = the random error term, assumed to be normally distributed with mean = 0 and variance = σ_ϵ^2.

The theory predicts that δ_2 should be significantly positive for options maturing after the earnings announcement date and not significantly different from zero for options maturing prior to the earnings announcement date. In addition, the theory predicts that δ_1 should be significant and positive, with a value of 1 in the absence of measurement error. Section II discusses the measurement of the variables along with several other econometric issues related to the estimation of equation (12).

II. SAMPLE SELECTION AND VARIABLE MEASUREMENT

Sample Selection

All four hypotheses are tested on the same sample of firms. The primary constraint on sample size is the availability of data for estimating the implied variances of return necessary for the tests of H3 and H4. A sample of 100 firm/year observations was selected from the population of firm/years on the Chicago Board of Options Exchange (CBOE) data base provided by the University of California-Berkeley. To be included in the sample, firms had to be listed in the *Standard and Poor's Earnings Forecaster* with at least four forecasts of earnings available (to estimate the variance of analysts' forecasts) at the date chosen to estimate the implied variance.[3] In addition, the firms had to have options that expired in both the quarter before and after the date of the annual earnings announcement. This limitation was imposed in order to allow estimation of equation (11) for options maturing both before and after the annual earnings announcement date. The Berkeley CBOE tapes cover the period from June of 1977 through December of 1979, omitting the months of November 1977, and June 1979.

Some firms are included in the sample more than once, since they meet the sample selection criteria in multiple years but no firm is represented more than twice. No fiscal year end or industry membership limitations were imposed. However, the majority of firms included had December fiscal year ends. Table 1 provides a listing of the sample with data on the fiscal year end month and industry (four digit SIC code). Table 2 provides some summary statistics concerning the industry representation in the sample and the timing of the fiscal year ends.

The date of *The Wall Street Journal* in which the annual earnings announcement appeared for each firm/year was used as the date of the event corresponding to t^* in equation (8). Table 1 also includes information concerning this date for each of the firm/years in the sample.

Measurement of Variables

The testing of the four hypotheses

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[3] The *EF* is a weekly publication of the available forecasts of annual earnings per share provided by a group of approximately 50 analysts for each of a large number of companies. A frequency distribution of the number of analysts' forecasts actually used in estimating the variances of analysts' forecasts is as follows:

	Number of Analysts' Forecasts					
	4	*5*	*6*	*7*	*8*	*9*
Number of firms	49	28	9	10	3	1

TABLE 1

SAMPLE FIRMS WITH INDUSTRY MEMBERSHIP, FISCAL YEAR END, AND EARNINGS ANNOUNCEMENT DATE

PANEL A: 1977 Sample Observations

Firm Name	Industry Code	Fiscal Year End	Earnings Announcement	Firm Name	Industry Code	Fiscal Year End	Earnings Announcement
1. Houston Oil & Minerals	1311	December	03-06-78	30. General Electric	3600	December	01-27-78
2. Schlumberger Ltd.	1389	December	02-16-78	31. RCA Corp.	3651	December	01-20-78
3. Fluor Corporation	1600	October	12-13-77	32. AMP Inc.	3670	December	01-24-78
4. Halliburton Company	1600	December	02-08-78	33. National Semiconductor	3674	May	06-26-78
5. Reynolds (R. J.) Inds.	2111	December	02-17-78	34. Texas Instruments	3674	December	02-03-78
6. Weyerhauser Company	2400	December	01-26-78	35. International Harvester	3711	October	11-30-77
7. Boise Cascade Corporation	2600	December	01-25-78	36. Boeing Company	3721	December	02-07-78
8. International Paper Co.	2600	December	01-18-78	37. American Hospital Supply	3841	December	02-07-78
9. Johnson & Johnson	2649	December	02-24-78	38. Baxter Travenol Labs	3841	December	02-02-78
10. Minnesota Mining and Mfg.	2649	December	01-24-78	39. Eastman Kodak	3861	December	02-10-78
11. DuPont E I De Nemours & Co.	2800	December	01-24-78	40. Polaroid Corp.	3861	December	02-23-78
12. Dow Chemical	2800	December	02-03-78	41. Xerox Corp.	3861	December	01-25-78
13. Monsanto	2800	December	01-27-78	42. Burlington Northern	4011	December	01-23-78
14. Merck & Company	2830	December	01-25-78	43. Delta Airlines	4511	June	07-28-78
15. Syntex Corporation	2830	July	09-08-77	44. Northwest Airlines, Inc.	4511	December	02-16-78
16. Colgate-Palmolive	2841	December	02-17-78	45. UAL Inc.	4511	December	01-27-78
17. Avon Products	2844	December	02-02-78	46. American Telephone			
18. Atlantic Richfield	2911	December	01-24-78	& Telegraph	4811	December	02-02-78
19. Exxon	2911	December	01-25-78	47. CBS, Inc.	4830	December	02-09-78
20. Kerr-McGee	2911	December	02-15-78	48. Commonwealth Edison	4911	December	01-20-78
21. Mobil Corporation	2911	December	01-26-78	49. Southern Co.	4911	December	01-23-78
22. Standard Oil Co. (Indiana)	2911	December	01-25-78	50. Bank America	6025	December	01-19-78
23. Burroughs Corp.	3573	December	01-18-78	51. Citicorp	6025	December	01-18-78
24. Digital Equipment Corp.	3573	June	08-10-78	52. Great Western Financial	6120	December	01-12-78
25. Hewlett-Packard	3573	October	11-24-77	53. American Express Co.	6199	December	01-25-78
26. Honeywell	3573	December	01-26-78	54. MGIC Investment Corp.	6199	December	02-22-78
27. IBM	3573	December	01-17-78	55. INA Corp.	6332	December	01-26-78
28. NCR Corp.	3573	December	01-20-78	56. Holiday Inns, Inc.	7011	December	02-14-78
29. Sperry Corp.	3573	March	04-28-78	57. Walt Disney Productions, Inc.	7990	September	11-11-77

TABLE 1—*Continued*

PANEL B: 1978 Sample Observations

Firm Name	Industry Code	Fiscal Year End	Earnings Announcement
1. Houston Oil & Minerals	1311	December	03-08-79
2. Schlumberger Ltd.	1389	December	02-14-79
3. Halliburton Company	1600	December	02-08-79
4. Weyerhauser Company	2400	December	02-02-79
5. Boise Cascade Corporation	2600	December	01-25-79
6. International Paper Co.	2600	December	01-17-79
7. Johnson & Johnson	2649	December	02-23-79
8. Minnesota Mining and Mfg.	2649	December	01-24-79
9. DuPont E I De Nemours & Co.	2800	December	01-16-79
10. Dow Chemical	2800	December	02-07-79
11. Monsanto	2800	December	01-25-79
12. Upjohn Co.	2830	December	02-21-79
13. Colgate-Palmolive	2841	December	02-16-79
14. Atlantic Richfield	2911	December	01-23-79
15. Exxon	2911	December	01-26-79
16. Mobil Corp.	2911	December	01-25-79
17. Standard Oil Co. (Indiana)	2911	December	01-24-79
18. Teledyne, Inc.	3510	December	01-12-79
19. Black & Decker Mfg.	3540	September	10-20-78
20. Burroughs Corp.	3573	December	01-17-79
21. Control Data Corp.	3573	December	01-24-79
22. Hewlett-Packard	3573	October	11-29-78
23. Honeywell	3573	December	01-18-79
24. IBM	3573	December	01-16-79
25. General Electric	3600	December	01-26-79
26. AMP, Inc.	3670	December	01-25-79
27. Texas Instruments	3674	December	02-02-79
28. Boeing Company	3721	December	02-06-79
29. Eastman Kodak	3861	December	02-21-79
30. Polaroid Corp.	3861	December	02-23-79
31. Burlington Northern	4011	December	01-23-79
32. UAL, Inc.	4511	December	01-26-79
33. American Telephone & Telegraph	4811	December	01-31-79
34. CBS, Inc.	4830	December	02-15-79
35. Commonwealth Edison	4911	December	01-19-79
36. Sears, Roebuck & Co.	5311	January	03-13-79
37. K-Mart	5331	January	03-21-79
38. Bank America	6025	December	01-23-79
39. Citicorp	6025	December	01-17-79
40. Great Western Financial	6120	December	01-11-79
41. American Express Co.	6199	December	01-19-79
42. INA Corp.	6332	December	01-24-79
43. Walt Disney Productions, Inc.	7990	September	11-02-78

TABLE 2

SUMMARY INFORMATION ON FISCAL YEAR END AND INDUSTRY MEMBERSHIP OF SAMPLE FIRMS

PANEL A: Fiscal Year End

Fiscal Year End Month	*Number of Firms*	*Number of Observations*
January	2	2
March	1	1
May	1	1
June	2	2
July	1	1
September	2	3
October	3	4
December	51	86
Total	63	100

PANEL B: Industry Membership

Two Digit Industry Code	*Number of Firms*	*Number of Observations*
13	2	4
16	2	3
21	1	1
24	1	2
26	4	8
28	8	12
29	5	9
35	10	14
36	5	8
37	2	3
38	5	7
40	1	2
45	3	4
48	2	4
49	2	3
53	2	2
60	2	4
61	3	5
63	1	2
70	1	1
79	1	2
Total	63	100

developed in the last section requires measures of (1) the variance of analysts' forecasts, (2) unexpected earnings, (3) the variance of return during earnings announcement periods, (4) the normal variance of return, and (5) the implied variance of returns. The procedures used to obtain these measures are described below.

Variance of Analysts' Forecasts. Data

on the raw forecasts were taken from the *Standard and Poor's Earnings Forecaster* (*EF*). For each firm covered by *EF*, several analysts provide their forecasts of EPS. The contributing analysts provide *EF* with their forecast changes and additions on a regular basis.

Since the variable of interest is the variance of the distribution of the accounting earnings signal that is held by the market at the date of the implied variance calculation, forecasts for the sample of firms were collected from the issue of the *EF* most current at the implied variance calculation date. The forecasts published in *EF* are assumed to represent the current expectations of future EPS held by the forecasters. If no change has occurred from prior issues, it is assumed that the expectation of that forecaster has not changed.[4] We use the label s_f^2 for the estimate of the variance of analysts' scaled earnings forecasts (σ_f^2) and calculate s_f^2 for each firm as follows:

$$s_f^2=\frac{\sum_{i=1}^{I}(F_i/\bar{F}-1)^2}{(I-1)} \qquad (13)$$

where

I = the number of forecasts of earnings for the firm available on the date of the implied variance computation,

F_i = the forecast of earnings for the firm from the ith analyst, and

$\bar{F}=\sum_{i=1}^{I}F_i/I.$

Unexpected Earnings. Unexpected earnings (*UE*) are defined as actual earnings minus the expected value of earnings divided by expected earnings. Actual earnings for the 100 firm/years were collected from appropriate issues of *EF*. Expected earnings were measured as the mean analysts' forecast. For the 100 firm/years in the sample, *UE* had a mean value of −.00784 and a standard deviation of 0.48773, suggesting very little bias in the mean analysts' forecast.

Variance of Return During the Earnings Announcement Period. To estimate the variance of return during the earnings announcement period, an event period had to be defined. To obtain a measure of the variance of return on an *ex post* basis, a five-day event window was used consisting of two trading days before and after the earnings announcement date and the actual earnings announcement date as the middle of the event window.

The estimate of the variance of return during an earnings announcement period is labeled s_e^2 (i.e., s_e^2 is an estimate of σ_e^2) and is measured as the squared deviation around the mean return for the five-day period.[5] The measure of the event period variance can be written as follows:

$$s_e^2=\frac{\sum_{t=1}^{5}(R_t-\bar{R})^2}{4} \qquad (14)$$

where

$\bar{R}$ = the mean return to a share of stock during the 30 days immediately preceding the five-day event period.

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[4] If this assumption is violated, then the variance of analysts' forecasts is measured with error. For instance, analysts might update their forecasts at prespecified times. If so, the summary contained in *Standard and Poor's Earnings Forecaster* may not be altogether current and tests based upon this summary should be unable to reject the null hypothesis.

Because of this problem, an alternative measure of the dispersion of analysts' forecasts was also used. The difference between the two most recent forecasts was used in model (12) and the results of the estimation were fundamentally unchanged.

[5] The variance of return in the earnings announcement period was also measured using two- and three-day event periods with results that are essentially identical to those reported here. See fn. 11.

Normal Variance. An estimate, s_n^2, of the normal variance in stock returns, σ_n^2, was obtained for each firm as follows. A historical sequence of daily returns from the Center for Research in Security Prices Daily Returns file was obtained for a 30-day period ending on the implied variance calculation date for options which expired after the earnings announcement.[6] This interval of time was selected to exclude any information events directly related to earnings (such as quarterly earnings announcements). However, for 33 of the 100 firm/years, this period included the first week of January, a time period which has been observed by Keim [1983] and others to be a period of unusual activity. Therefore, to preclude the "January effect" from influencing the calculation of the normal variance, the first week of January was dropped from the time series of returns for the 33 affected firms and a week was added at the beginning of the time series. The variance of returns was estimated for each firm in models (1) and (2) as follows:

$$s_n^2 = \frac{\sum_{k=1}^{K} (R_k - \bar{R})^2}{(K-1)} \qquad (15)$$

where

K = the number of trading days,
R_k = the return to a share of stock on day k, and
$\bar{R}$ = the mean return to a share of stock during period 1 to k.

Implied Average Variance of Returns. For convenience, the regression model in equation (12) that has the implied variance of returns to maturity for options maturing just after (before) the annual earnings announcement as the dependent variable is hereafter referred to as model (1) (model (2)). The implied average variance of returns to maturity, σ_i^2, (hereafter referred to as "implied variance"), was estimated using the Black and Scholes option pricing model and a numerical solution process. The numerical solution process produces an estimate of this average implied variance of return, labeled s_i^2, on the underlying stock over the interval of time from the date of calculation to the maturity date of the option. Obtaining this estimate requires observations, at the date of calculation, of the call option price, the price of the underlying stock, the exercise price of the option, the risk-free rate of interest, and the time remaining to maturity. This information was available from the Berkeley CBOE Options data base.[7]

The numerical solution procedure used to estimate the implied variance is described below and is the same as that used by Patell and Wolfson [1979].[8] For each stock on which options are written there may be several options with different expiration dates or exercise prices. To develop estimates of the implied variance for inclusion in model (2) (options expiring prior to the earnings announcement), the options expiring closest, but prior to the *WSJ* announcement date were used. The implied variance on the date 30 calendar days prior to the maturity of the option was estimated. Thirty days was chosen to avoid estimation problems that previous studies have documented are present when the maturity of the option is very short. For the estimation of the implied variance for use in model (1) (options maturing after the earnings announcement), options with the earliest maturity date after the earnings announcement date were used and each firm's implied average variance to maturity was estimated on the first trading day at least 30 days before the *WSJ* announcement date.[9] The effect of any variance increase during the earnings announcement period should be most pronounced in these shorter options. Since the Black and Scholes model appears to be better specified for "near-the-money" options, those options with exercise prices closest (both above and below) to the current stock price were chosen for the implied variance computation. Since the data base provides the highest and lowest trading price for each option during any period in which the underlying stock price is constant, an average of prices was used to compute the implied variance.[10] A representation of the periods used for implied variance estimates (along with the normal variance estimate discussed below) is presented in Figure 1 for one of the sample firms, American Hospital Supply.

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[6] While the 30-day period is arbitrary, its choice was motivated by the need for a period long enough to efficiently estimate the variance of returns in non-announcement periods without risking the inclusion of a quarterly earnings announcement. In addition, use of the actual time series of returns permits the normal variance of returns to include all factors present in the estimation period which affected stock price, i.e., industry factors. As usual, stability of the returns generating process over the estimation period and until the option matures is assumed.

[7] The risk-free rates of interest provided in the Berkeley CBOE Options data base are Treasury Bill ask rates provided by Interactive Data Corporation. The rate used in the estimation of the implied variance of return was the rate associated with T-bills whose maturity date most closely corresponded to the maturity date of the option.

[8] The Black and Scholes model assumes that the stock pays no dividends over the life of the option. When that assumption was violated in our sample, an adjustment procedure for dividends was employed which is based on the approach suggested by Black [1975] and is identical to that used by Patell and Wolfson [1979].

The procedures described above yield a systematic difference between the time to maturity of the options used in models (1) and (2). The implied variance in model (2) was estimated in all cases on a date 30 days prior to maturity of the options, while the implied variance in model (1) was estimated in all cases on a date *more* than 30 days prior to maturity of the options. Patell and Wolfson [1981] documented a steady increase in the implied variance of return as the options approach maturity. Therefore, any differences observed in the implied variances between models (1) and (2) may be due to systematic differences in time to maturity rather than the timing of the earnings announcement. As a consequence of this possibility, the following alternative procedure for measuring the implied variances for use in model (2) was also applied. Model (2) implied variances were estimated on a date that was the same number of days prior to maturity as in model (1).

There were two problems with this alternative approach. First, data unavailability reduced the sample size to 98 firm/years. Second, increasing the time to maturity used in model (2) made it more likely that the third quarter earnings announcement would occur between the estimation date and the maturity of the option, thus confounding the results. Despite these problems, results of the alternative measurement procedure for model (2) were not significantly different from the results based on the primary measurement procedure and, therefore, are not reported in Section III.

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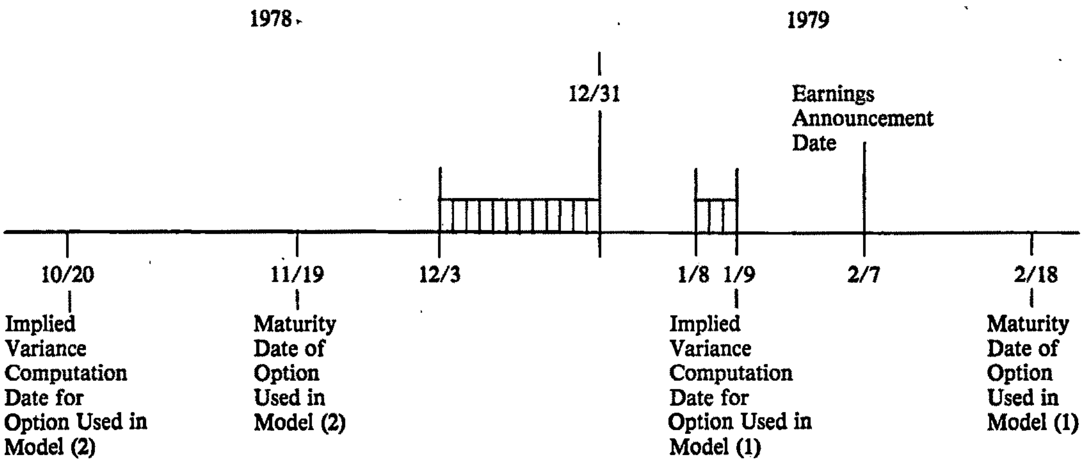
[9] The use of a 30-day criterion was motivated by the desire to obtain estimates of the implied variance which were uncontaminated by other anticipated information events. Recall that the variance of analysts' forecasts was calculated at about the same point as the calculation of the implied variance. The calculation of the variance of analysts' forecasts so close to the date of the earnings announcement produces smaller variance estimates than if the calculation was made at an earlier point in time. Our results suggest this measurement tradeoff did not seriously impair the power of the tests.

[10] On any given day, an implied variance can be calculated for each interval of time during which the stock price remains constant. The availability of multiple constant stock price intervals on a given day resulted in multiple computations of s_i^2 for each firm (ranging from 4 to 236) on the calculation date. The measure of s_i^2 which was used in the analysis was the arithmetic mean of the individual computations.

FIGURE 1

EXAMPLE OF IMPLIED VARIANCE ESTIMATION DATES FOR OPTIONS USED IN MODELS (1) AND (2) AND ESTIMATION PERIOD FOR NORMAL VARIANCE OF RETURN (CASE OF AMERICAN HOSPITAL SUPPLY CORP.)


1978
1979
12/31
Earnings Announcement Date
10/20
Implied Variance Computation Date for Option Used in Model (2)
11/19
Maturity Date of Option Used in Model (2)
12/3
1/8
1/9
Implied Variance Computation Date for Option Used in Model (1)
2/7
2/18
Maturity Date of Option Used in Model (1)

▥ Indicates the dates used to estimate the normal variance of return on the underlying stock. Note omission of the first week of January to avoid "January effect."

Table 2 indicates that several different industries are represented in the sample. In addition, the earnings announcement dates are typically not common (at most six firms had the same earnings announcement date in any one year). This in turn implies that the measurement date of the implied variance is not generally common across firms. Since the implied variance is the dependent variable in regression models (1) and (2), and since it is being estimated for a sample of firms with wide industry representation with widely divergent measurement dates, cross-sectional dependency is not likely to be present. Cross-sectional dependency in the residuals of equation (12) would generally be the result of taking all the measures of the dependent variable contemporaneously, such that an omitted variable (such as an industry information release) would affect all the firms in the sample simultaneously. Since the measurement dates of the implied variance are not common, the errors would only be correlated if there was some sort of serial correlation process at work in the way such announcements affect stock or option prices. There is no evidence of significant serial correlation in stock returns and, thus, there should not be any significant cross-sectional correlation in the residuals of equation (12).

Descriptive statistics for variables in tests of all hypotheses are reported in Table 3.

III. RESULTS

Tests of Hypothesis H1

Hypothesis H1 relates to the correlation between the estimate of the variance of analysts' forecasts (s_f^2) and the

TABLE 3

SAMPLE DESCRIPTIVE STATISTICS[1]

PANEL A: Means, standard deviations, minimums, maximums, and deciles of the sample

	UE	s_f^2	s_n^2	s_{ib}^2	s_{ia}^2	s_e^2	T
Mean	−.00455	.00167	.00025	.00024	.00023	.00056	80.8
Std. Deviation	.079516	.003537	.000196	.000191	.000175	.001600	33.2
Minimum	−.3324	.000000	.000017	.000018	.000011	.000010	31
Maximum	.1734	.024920	.001111	.001207	.000856	.015281	121
Deciles:							
.10	−.0916	.000072	.000086	.000076	.000068	.000045	32
.20	−.0306	.000129	.000113	.000118	.000104	.000085	40
.30	−.0188	.000176	.000137	.000144	.000126	.000139	53
.40	−.0030	.000306	.000160	.000159	.000158	.000178	60
.50	.0056	.000475	.000196	.000171	.000204	.000226	87
.60	.0113	.000620	.000226	.000207	.000223	.000275	102
.70	.0151	.000980	.000271	.000229	.000250	.000404	109
.80	.0358	.001706	.000323	.000330	.000308	.000607	115
.90	.0615	.003812	.000488	.000525	.000374	.001036	120

PANEL B: Sample correlation coefficients

	UE	s_f^2	s_n^2	s_{ib}^2	s_{ia}^2	s_e^2	T
UE	1.000						
s_f^2	−.052	1.000					
s_n^2	−.055	.524	1.000				
s_{ib}^2	−.104	.479	.796	1.000			
s_{ia}^2	−.134	.491	.764	.835	1.000		
s_e^2	−.089	.053	.236	.225	.206	1.000	
T	.157	−.028	−.074	−.224	−.326	−.043	1.000

[1] Key to variable names: *UE*=unexpected earnings (scaled by mean forecast)
s_f^2=forecast variance (scaled by mean forecast)
s_n^2=normal variance
s_{ib}^2=implied variance, maturing before earnings announcement
s_{ia}^2=implied variance, maturing after earnings announcement
s_e^2=variance during announcement period
T=time to maturity

magnitude of unexpected earnings (*UE*). Note that it is the magnitude of the realized deviation from expected earnings, regardless of sign, that is expected to be positively associated with the variance of analysts' forecasts. Since *UE* as measured can be either positive or negative, two transformations of *UE*, the absolute value of *UE* and UE^2, were used in tests of H1. Sample Pearson product-moment correlation coefficients between s_f^2 and the absolute value of *UE* and UE^2 were estimated at .347 and .201, respectively, both significantly different from zero at $p < .01$. This evidence is consistent with the hypothesis of a positive association between the variance of analysts' forecasts and the magnitude of *ex post* deviations from expected earnings.

Tests of Hypothesis H2

Hypothesis H2 is tested by estimation of equation (4) relating the estimates of

TABLE 4

REGRESSION OF THE *EX POST* VARIANCE OF RETURNS DURING THE EARNINGS ANNOUNCEMENT PERIOD ON THE NORMAL VARIANCE OF RETURNS AND THE VARIANCE OF ANALYSTS' FORECASTS OF EARNINGS

PANEL A:								
Model:	$s_e^2=$	β_0	+	$\beta_1 s_n^2$	+	βs_f^2	+	ϵ
Coefficient:		.00006		2.342		−.0440		
(t-statistic)		(0.22)		(2.49)		(−0.85)		
$R^2=.043$								
PANEL B:								
Model:	$CAR=$	β_0	+	$\beta_1 UE$	+	ϵ		
Coefficient:		−0.0009		0.0586				
(t-statistic)		(−0.20)		(1.01)				
$R^2=.01$								

ex post variance of return during the earnings announcement period to the estimates of the pre-announcement normal variance and the variance of analysts' forecasts of earnings. Results from this estimation are presented in panel A of Table 4.

Results suggest that the normal variance is positively and significantly related to the *ex post* variance of return during the earnings announcement period as predicted. However, the coefficient on the variance of analysts' forecasts is negative and insignificant, contrary to the predictions of H2. In light of the significant association between the variance of analysts' forecasts and the *ex post* magnitude of unexpected earnings, and the significant *ex ante* association present in tests of H3 reported below, the lack of a significant positive association between the *ex post* variance of returns during the event period and the variance of analysts' forecasts is puzzling.

The motivation for estimating equation (4) is to provide evidence on the significance of the relation between the variance of analysts' forecasts and the *ex post* variance of stock returns for our limited sample. Expression (4) may not hold on an *ex post* basis in small samples. An assumption of rational investors only requires that on average (i.e., in large samples), the *ex ante* beliefs are realized on an *ex post* basis.

One reason why the relation may not hold, *ex post*, is that it is difficult to specify an event period for an earnings release.[11] Previous research indicates that this problem is overcome in large samples. However, in the limited sample used here, the problem could be severe.

Another reason for the lack of a significant positive coefficient on the variance of analysts' forecasts is that the earnings response coefficient in equation

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[11] Alternative event windows were used to test the sensitivity of the results reported in panels A and B of Table 4. While reported results use a five-day event window centered on the announcement date as day zero, the following two- and three-day event windows were also examined: (−1, 0), (0, 1), and (−1, 0, 1). The results were essentially unaffected by the use of these alternative event window specifications.

(1), γ, may not be cross-sectionally constant. Thus, while the variance of analysts' forecasts may serve well as a proxy for the uncertainty about the future earnings signal, it may also be associated with the differential coefficients on unexpected earnings. In such a case, equation (4) is misspecified.

Finally, the lack of a significant coefficient of s_f^2 in equation (4) may be due to a weak relation between *ex post* unexpected earnings and *ex post* unexpected returns in our sample.[12] Note that the relation between the variance of analysts' forecasts and the *ex post* variance of returns accompanying the earnings announcement is predicated on the existence of a relation between the *ex post* unexpected earnings and the *ex post* unexpected returns. A test of the significance of the latter for our sample was performed by estimating the following model:

$$CAR_i = \alpha + \beta UE_i + \epsilon_i \qquad (16)$$

where

CAR_i = the cumulative average residual return of firm *i* over the five-day event period, and

UE_i = (actual earnings − expected earnings)/expected earnings of firm *i* where expected earnings are measured by the mean of the analysts' forecasts.

If the relation in equation (16) is weak in our sample, then the relation in equation (4) is also likely to be weak. On the other hand, if the relation in equation (16) is significant, then the relation in equation (4) should be significant unless measurement error is so severe as to result in a significant attenuation bias. In sum, the estimation of equation (16) should help our understanding of the insignificant coefficient on s_f^2 in equation (4).

Results of the estimation of equation (16) are presented in panel B of Table 4. The relation between the *CAR* and the standardized measure of *UE* is positive, but not significant. Therefore, one reason that the variance in analysts' forecasts of earnings does not help explain security return variance during earnings announcement periods in our sample is the weakness of the stock price reaction to earnings announcements.

Tests of Hypotheses H3 and H4

Both H3 and H4 are tested by estimating equation (12). The test for H3 (H4) requires use of the average variance of return to maturity implied by the prices of options maturing after (before) the earnings announcement date. The regression model used to test H3 is referred to here and in Table 5 as model (1) while the model used to test H4 is referred to as model (2).

To test H3, equation (12) was estimated using the average variance of return to maturity implied by the prices of options expiring *after* the earnings announcement date as the dependent variable. Results of the estimation process are presented as model (1) in panel A of Table 5. For model (1), the coefficient associated with the analysts' forecast variance is significantly positive (at the .05 level). While the coefficient associated with the normal variance is significantly positive (at the .01 level in a one-tailed test), it is also significantly less than the predicted value of one. Moreover, the intercept is significant at the .05 level in a two-tailed test.

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[12] The results of Oppong [1980] and Atiase [1985] suggest that the lack of a market reaction to earnings announcements of large firms (such as those included in the present sample) is not all that unusual a finding. Atiase [1985, p. 22] concluded that his findings "strongly support the hypothesis that the degree of unexpected security price changes in response to earnings reports is inversely related to the capitalized value (size) of firms."

TABLE 5

THE REGRESSION OF THE AVERAGE VARIANCE OF RETURN TO MATURITY IMPLIED BY THE PRICES OF CALL OPTIONS ON THE NORMAL VARIANCE OF RETURNS AND THE VARIANCE OF ANALYSTS' FORECASTS OF EARNINGS[1]
(*t*-STATISTICS IN PARENTHESES)

Model:[2] $s^2(T)=$	δ_0	+	$\delta_1 s_n^2$ *Normal Variance*	+	$\delta_2(s_f^2/T)$ *Analysts' Forecast Variance*	+	ϵ
PANEL A: Full models with no adjustment for heteroscedasticity							
Model (1)	.00007		.600		.631		Adjusted $R^2=.605$
	(3.78)		(9.28)		(2.69)		
Model (2)	.00005		.733		.139		Adjusted $R^2=.632$
	(2.66)		(10.51)		(1.20)		
PANEL B: Full models with adjustment for heteroscedasticity							
Model (1)	.00006		.620		.694		
	(3.56)		(8.89)		(2.73)		
Model (2)	.00004		.753		.170		
	(3.14)		(9.42)		(1.16)		
PANEL C: Partial model (2) with no adjustment for heteroscedasticity							
Model (2)	.00005		.777		n/a		Adjusted $R^2=.631$
	(2.52)		(13.04)				
PANEL D: Partial model (2) with adjustment for heteroscedasticity							
Model (2)	.00004		.803		n/a		
	(3.24)		(10.30)				

[1] Model (1) is estimated using the average variance of return to maturity implied by call options maturing *after* the earnings announcement date as the dependent variable. Model (2) is estimated using the average variance of return to maturity implied by call options maturing *before* the earnings announcement date as the dependent variable.

[2] $s^2(T)$ = average variance of return to maturity implied by options maturing in T periods.

To test H4, equation (12) was estimated using the average variance of return to maturity implied by the prices of options expiring *before* the earnings announcement date as the dependent variable. The results are presented as model (2) in panel A of Table 5 and are consistent with our predictions. In particular, the coefficient associated with the normal variance measure is significantly positive (at the .01 level) although it is still significantly different from its theoretical value of one. Of more interest is the fact that the coefficient associated with the variance of analysts' forecasts is not significant at the .10 level. As with model (1), note that the intercept is significant (at the .05 level in a two-tailed test).

Comparison of the two coefficients in panel A of Table 5 reveals the coefficient of s_f^2 is greater in model (1) than in model

(2) (.631 compared to .139) but it is not necessarily the case that the difference between the coefficients is significant. A *t*-test using a pooled variance estimate from both models (1) and (2) showed a positive and significant (at the .05 level in a one-tailed test) difference in the coefficient associated with the analysts' forecast variance between model (1) and model (2).

In general, the results support hypotheses H3 and H4 reasonably well. However, the possible misspecification of the model as indicated by significant intercept terms in both the model (1) and model (2) regressions and by estimated coefficients on s_n^2 that differ from their theoretical values of one requires further investigation before conclusions can be drawn.

Specification Issues. We investigated two issues related to the specification of equation (12). The issues are the assumed linearity of the relation and the assumed homogeneity of the residual variance. To address linearity, models (1) and (2) were estimated after ranking the observations by the values of each independent variable. This required two estimations, one for each of the independent variables. If the model were nonlinear, then the error terms which emerge from this estimation process should demonstrate significant serial correlation since the regression procedure is attempting to fit a linear model to what is actually a curvilinear relation. The Durbin-Watson statistic was used to evaluate the significance of the serial correlation in each of the two instances. In no case was the Durbin-Watson statistic significantly different than its expected value under the null hypothesis of 2.00 for either model (1) or model (2). These results suggest that the form of the actual relation between s_i^2 and s_n^2 and s_f^2 in our sample is reasonably consistent with the linear form assumed in equation (12).

To address homogeneity, a Goldfeld and Quandt [1965] test was performed with each of the independent variables to see if a significant relation existed between the magnitude of the independent variable and the variance of the error terms. This test proved significant for the normal variance and analysts' forecast variables, but the relation was considerably stronger for the normal variance (the test statistic was approximately three times larger for the normal variance). To determine how this heterogeneity affected our results, we reestimated equation (12) using a procedure developed by Park [1966]. This approach (described more fully in an appendix to this paper) allows greater flexibility in making adjustments for heteroscedasticity than simply scaling by an *ad hoc* variable (or the square root of one of the independent variables), maintaining the consistent and asymptotically unbiased properties of the estimators in equation (12).

After the Park [1966] adjustment, the heteroscedasticity tests associated with the independent variables in model (2) are insignificant in all cases. In model (1), heteroscedasticity is reduced but is still significant. In no case do the results of any hypothesis test described change as a function of the use of the adjustment for heteroscedasticity. However, the transformations make the explanatory power of the regressions difficult to interpret with the traditional R^2 measure and, hence, they are not reported for the regressions that are adjusted for heteroscedasticity.

The results using the Park estimation procedure are reported in panel B of Table 5 and are not substantially different from those of panel A. The significance of the normal variance term coefficient declined slightly, but the results regarding the coefficient of the variance of analysts' forecasts is virtually unaffected. When the Goldfeld and Quandt test is applied to model (2) as estimated using the Park procedure, there is no longer any significant relation between the transformed normal variance variable and the error terms from the model in panel B (the test statistic has a value of 1.00, while a significant *F*-ratio would require a value in excess of 1.84). In summary, the use of the Park procedure to estimate models (1) and (2) produces the same results as are associated with OLS estimation procedures. In particular, the model still performs as anticipated, with the exception of a significant intercept term and a lower than expected value for the coefficient associated with the normal variance term.

The persistent deviation of the intercept term and the coefficient of normal variance from their predicted levels suggests it may be appropriate to estimate the model (2) version of equation (12) without the variance of analysts' forecasts variable. There are two potential benefits from running such a regression: (1) the results can be compared to those of previous studies on the association between stock price variances and the implied variances from the option pricing model, and (2) the results will provide evidence on whether the inclusion of the analysts' forecast variance is causing the intercept and coefficient on normal variance to deviate from their theoretical values of zero and one, respectively.

Model (2) was estimated without the variance of analysts' forecasts measure and without the transformation to adjust for heteroscedasticity. The adjustment for heteroscedasticity was omitted, to directly compare the results to those of Latané and Rendleman [1976]. The results of this estimation are reported in panel C of Table 5. The R^2 from this regression is .63 which is almost identical to that estimated by Latané and Rendleman who report a correlation between implied variance and the normal variance of return of .8 or an R^2 of .64. The Goldfeld and Quandt test indicates a significant violation of the assumption of homogeneous variance in this regression also. Panel D of Table 5 reports results of estimating this reduced model with an adjustment for heteroscedasticity. The results are similar to the OLS results in all important respects. In panels C and D the intercept terms are still significantly positive and the coefficients of normal variance are still significantly different from their theoretical values of one. Therefore, it does not appear that inclusion of the analysts' forecast is the reason for the parameter estimates' deviation from their predicted values in the full versions of models (1) and (2).

Finally, we note that there is positive correlation among the independent variables in these models. The pair-wise correlations between the variance of analysts' forecasts and the normal variance of return after the transformation for heteroscedasticity was .554. While this is statistically significant, the absolute magnitude is not likely to cause serious problems with the inversion of the matrix of independent variables, which would, in turn, cause major estimation problems.

IV. SUMMARY

This paper's major results are consistent with the hypothesis that the variability in analysts' forecasts captures a significant portion of the variability in forthcoming earnings signals as perceived by option market participants. Evidence presented here suggests that the empirical model deviates from the theory's predictions in some systematic and potentially important ways. However, our results are consistent with those previously reported, where these specification problems were not identified. Thus, the model specification results should contribute to the understanding of the behavior of the empirical analogue of the option pricing model.

While the results are not without some ambiguity, they are consistent with the hypothesis that the cross-sectional variance of analysts' forecasts of earnings is useful as an *ex ante* measure of the market's uncertainty about the future earnings signal. The empirical evidence provided is consistent with the theoretical predictions of a positive association between the variance of analysts' forecasts and (1) the *ex post* magnitude of unexpected earnings and (2) the average variance of return to maturity implied by prices of options maturing after (but not before) earnings announcement dates.

Tests of the relation between the variance of analysts' forecasts and the *ex post* variance of returns during the earnings announcement period failed to confirm the hypothesis of a significant positive association. In retrospect, this may not be surprising since the relation between unexpected returns and unexpected earnings was not statistically significant in our sample of large firms.

APPENDIX

THE PARK ADJUSTMENT FOR HETEROSCEDASTICITY

Park [1966] assumes that the general structure of the variance for the error term can be written as:

$$\sigma^2_{ui} = \sigma^2 X_i^{\lambda} e^{v} \tag{A1}$$

where

σ^2_{ui} = the variance of the error term for firm i without correction for heteroscedasticity,
σ^2 = the true constant variance,
X_i = the value of the independent variable for firm i,
λ = the unknown exponent of X_i, and
v = a well-behaved error term.

As such, the models which assume that the variance of the error term is a function of the square of the independent variable are a special case of Park. To operationalize this structure as a linear model simply requires taking the natural logarithm of both sides of equation (A1), and can be written as:

$$\ell n(\sigma^2_{ui}) = \ell n(\sigma^2) + \lambda \ell n X_i + v. \tag{A2}$$

To utilize this model, a joint estimation of the parameters in equations (12) and (A2) is necessary. First, equation (12) is estimated to obtain estimates for the error terms and these are then used to estimate the parameters in equation (A2). Each estimated error term from equation (12) is squared to produce an estimate of the variance for each individual firm in equation (A2). The results of estimating equation (A2) are then used to develop a transformation of the original variables in equation (12) which adjusts for the heteroscedasticity.

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Cross-Sectional Capital Market Research and Model Specification

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ABSTRACT: This paper examines the issue of model specification in cross-sectional capital market research. In particular, it is argued that the decision of whether to select a price level or price change (return) specification is a joint function of (1) the economic model of equilibrium that is assumed; and (2) the nature of the econometric properties of the data that cause OLS assumptions to be violated. The historical origins of the model specification debate are traced to focus on three compelling reasons for selecting a returns-based methodology. We conclude that the relative advantages of returns and levels methodologies are dependent upon the set of assumptions maintained by the researcher regarding the pricing relation and the econometric properties of the data used for estimation. We provide examples and an interpretation of extant accounting capital market research to help illustrate our conclusions.

CAPITAL market researchers often attempt to determine whether specific attributes (e.g., earnings) of firms are priced in the financial markets. Specific empirical hypotheses are proposed and then tested. In their seminal paper, Ball and Brown [1968] examine whether changes in *residual* security returns, determined from the market model (see Fama [1976]), are correlated with changes in accounting earnings. One can interpret their research as attempting to determine if unexpected changes in accounting earnings explain unexpected changes in security prices. Bowen [1981] examined whether a component of earnings of electric utilities thought to be of "lower quality" than the remainder of earnings is priced lower per dollar (is valued less) than the higher quality portion in a security price model.

The Ball and Brown and the Bowen studies illustrate two strains of the empirical literature: those examining *changes* in security prices (price change studies) and those examining the *levels* of security prices (levels studies). Price change studies (Ball and Brown) examine how *changes* in firm-specific attributes (earnings) are correlated with percentage changes in market prices. Levels studies (Bowen) examine whether *levels* of firm-specific attributes (earnings) are correlated with levels of security prices. With the notable exception of Christie [1987],

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few researchers have critically examined the relation between levels and changes papers. We view this as a reflection of the belief of most researchers that changes studies (and returns-based studies in particular) are more reliable than levels-based studies, making a comparison of returns and levels methodologies an uninteresting question.[1] Using a "market test" logic, such a belief is supported by the relative frequency of changes studies versus levels studies in the accounting literature; that is, if we view these methodologies as competitors, changes papers must be better because more of them appear. A manifestation of this "market test" is that one rarely observes researchers motivating the *assumption* that, for example, the market model is an appropriate pricing relation.

The purpose of this paper is twofold. First, we argue that the issue of appropriateness of econometric specification (levels versus changes) is unresolvable given the current state of capital market research, suggesting that biases for or against either methodology are unwarranted. Second, we argue that the econometric specification issue is actually a subset of a larger set of issues. In particular, the functional form of an empirical test examining whether a firm-specific attribute determines security prices is dictated by two sets of assumptions. These are:

1. The assumptions made (explicitly or implicitly) about the nature of capital market equilibrium;
2. The assumptions concerning the sources of econometric problems that are likely to affect experimental inferences (e.g., the structure of measurement errors, or which variables might be correlated omitted variables).

The remainder of this paper is structured as follows. In Section I, we describe the changes/levels specification problem in detail by placing the discussion in historical perspective. In Section II, we critically examine the claims regarding the desirability of the market model model/returns methodology relative to a levels one. There, we also construct examples that illustrate how specific assumptions dictate whether to specify a cross-sectional pricing model in price levels or changes form. In Section III, we illustrate how these examples provide a framework for interpreting the findings of existing empirical work in terms of these model specification issues. Section IV summarizes our major points.

I. HISTORICAL PERSPECTIVE

In a survey of market-based accounting research (MBAR), Lev and Ohlson [1982] question why price level models have largely been rejected by MBAR researchers. They attribute the rejection to the widely-held belief that price level (*valuation*) models lack sound theoretical grounding, whereas price change (*return*) models are theoretically grounded in a specific model of market equilibrium (the CAPM). Lev and Ohlson reference a highly influential paper in the accounting literature, Gonedes and Dopuch [1974], in making this point.

In section 8 of their study, Gonedes and Dopuch discuss the use of return models based on the CAPM, and valuation models in MBAR. Lev and Ohlson point out that Gonedes and Dopuch are highly optimistic concerning the ability of accounting studies that utilize research designs based on the CAPM to distinguish between competing hypotheses of accounting reporting techniques. In contrast, Lev and Ohlson characterize Gonedes and Dopuch as being highly pessimistic of the usefulness of dividend-earnings capitalization (valuation) models in a similar context. In particular, Gonedes and Dopuch argue that earnings capitalization models are derived under certainty, and are only extended to uncertainty using *ad hoc* procedures. That is, they argue it is difficult to interpret results from such studies because the underlying theoretical relation between security price and (say) earnings is not well-specified.[2]

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[1] Throughout this paper, we will refer to returns-based studies (e.g., those in which abnormal returns are regressed on transformed accounting variables) and changes studies interchangeably.

It is not surprising that Gonedes and Dopuch were critical of valuation-based accounting studies because of the apparent lack of theoretical soundness of valuation approaches. The most widely known valuation study at the time of the Gonedes and Dopuch study was Miller and Modigliani [1966], in which the cost of capital in the electric utility industry is estimated. Gonedes and Dopuch point out that the model used by Miller and Modigliani simply extends the certainty-based dividend-earnings capitalization model to uncertainty by adjusting the earnings discount rate of each risk class to reflect different relative risk.[3] This assumes that risk enters into the model multiplicatively (earnings divided by a *risky* interest rate). Because the adjustments for risk are *ad hoc*, i.e., not "implied by some specific theory of valuation under uncertainty," Gonedes and Dopuch argue "the interpretations to be ascribed to the model are not entirely clear cut."

Gonedes and Dopuch were apparently unaware of the Litzenberger and Rao [1971] study which estimated the cost of capital for electric utilities by using a *levels* model derived from the CAPM. Litzenberger and Rao, thus, "appropriately" adjust for the relative risk of securities under uncertainty. For our purposes, the merits of the Litzenberger and Rao study relative to the Miller and Modigliani study are unimportant; rather, Litzenberger and Rao illustrate the interdependence of price level and change studies, as suggested by Lev and Ohlson:

> The important point...is that the information content of any set of (accounting) variables must manifest itself on a valuation level as well as that of value changes.

We might, thus, refine the observations made by Gonedes and Dopuch as follows: "The problem with the (Miller and Modigliani) study was not that valuation was a flawed approach, but that their particular choice of valuation model was *ad hoc*."

Note that the Gonedes and Dopuch criticisms of valuation models appeared soon after market model methodologies were first developed. Thus, their criticisms came at a time when several methodological problems appeared to have been solved through the use of market model designs. First, the market model design appeared to incorporate uncertainty in a rigorous fashion (i.e., it could be interpreted in terms of the CAPM). Second, the structure of the market model (by assumption) created a solution to the "deflation problem" endemic to levels-based models. In the cross-sectional levels models investigated by Miller and Modigliani, among others, heteroscedasticity was a natural concern because observations from large firms were aggregated with those of small firms. In such levels studies, because there was no natural solution to the size-disparity problem, researchers typically resorted to *ad hoc* deflation procedures. In contrast, the market model design *by assumption* solves this deflation problem, because changes in the firms' market capitalization (over some predetermined period) are deflated by the beginning of the period market capitalization.[4] Third, the market model designs suggest a natural control group intuition for treatment of the data because the data are analyzed in changes form. The value of the firm's equity can be viewed as a function of a combination of the variables of interest (e.g., the capitalized value of earnings) and omitted variables. When we difference values of the equity to construct a return measure for the market model, we can think of the resulting difference as eliminating the omitted variables. That is, in *differenced form*, the firm's equity value in the previous period provides a control for the variables omitted from the specification.

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[2] See, for example, their discussion of Mlynarczyk [1969].

[3] Miller and Modigliani also added a "growth" term to allow for earnings growth in excess of the cost of capital for a finite period of time. Such a growth term is also grounded in a certainty-based model

The three advantages discussed above suggest the dominance of a market model design to address market-based accounting research questions. In the next section, we focus on these apparent advantages to accomplish two objectives. First, we draw attention to the crucial assumptions that lend returns designs their "soundness" in order to call into question the prevailing view that returns designs are superior to other designs. Second, we discuss two generic empirical research design issues incorporated into the returns design: deflation and differencing. Note, however, that we approach these two issues as fundamentally important design issues *without* assuming that the market model or CAPM is the appropriate asset pricing relation. We focus much of our discussion around the market model design to keep the discussion germane to the kinds of problems implicitly addressed by return methodologies. Our purpose is *not* to criticize the use of returns-based methodologies. Rather, our concern is as expressed by Lev and Ohlson: "...the key issue becomes identifying types of questions and circumstances under which one approach [levels or returns] is preferable to the other."

II. Returns Designs Reexamined

The Market Model and its Theoretical Link to Asset Pricing Under Uncertainty

An apparent advantage of the market model design is that it can be tied to a theory of asset pricing under uncertainty, suggesting that we can think of market model-based accounting studies as "rigorous" with respect to modern finance theory (especially the CAPM). However, note that any such advantage is predicated on a particular set of unverifiable (explicit or implicit) assumptions about the economy (e.g., the structure of agents' utility functions), which we call the researcher's "maintained hypothesis." Given a particular maintained hypothesis, we can interpret the researcher's results only in terms of the specific assumptions that we do not subject to empirical testing. Unlike laboratory experiments in the physical sciences, the capital markets researcher has no means of scientifically validating the unexamined assumptions that comprise the maintained hypothesis.[5] If these assumptions are false, the interpretations to be attached to empirical tests may be quite different from those if a different model of the economy were assumed.

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[4] We can view the work beginning with Patell [1976] as a further refinement of deflation techniques. Patell deflated residuals of each firm by an estimate of the residuals' standard deviation to adjust for heteroscedasticity in the variances of the residuals. Thus, the data analysis by Patell (and others) standardized the data twice, once to adjust the variables for firm size differences (as dictated by the market model), and once to adjust for *observed* differences in the residual variances.

The typical *explicit* assumption of accounting researchers is that the market model characterizes the "return-generating" process for securities to make inferences about the effects of an information item on a set of security prices. However, researchers typically make no attempt to determine if the assumptions required to justify their particular use of the market model are consistent with the setting in which the research is conducted. Analytical models that derive the market model as an equilibrium pricing relation are typically based on an assumption of perfect and complete markets, which would preclude a role for information in the valuation of securities.[6] We know of no analytical work focusing on the relevance of examining market model residuals in a setting in which "accounting" arises as equilibrium behavior.[7] By assuming that the market model is the unconditional return-generating model, the researcher *implicitly* makes any economic assumptions required to justify particular interpretations of the residual error moments (e.g., correlation of residuals with earnings changes suggests earnings changes cause price changes). That is, if the researcher pushes the link between the residual error moments and accounting data beyond documenting a statistical association, *some* equilibrium assumptions are being invoked. However, the existence of a market model-like pricing relation outside of very simple settings remains an open question.

The decision to interpret accounting data in terms of its relation to market model residuals thus forces arbitrary, largely untestable assumptions such as the following:

1. The regression parameters—except the parameters of the residual return generating process—are not functions of the accounting data of interest. For example, Ball and Brown [1968] needed to assume that the pricing effects of unexpected earnings changes are not part of beta times the market return. Alternatively, earnings changes were assumed to be additional *factors* in the asset pricing relation.[8]
2. Accounting data are suitable proxies for the underlying economic variable. This assumption is particularly important given the absence of a theory that relates accounting data to the variables appearing in economic models. For example, changes in accounting earnings often appears as a proxy for *economic* earnings changes, because economic earnings are unobservable. Stated more generally, the researcher must assume that measurement errors in accounting earnings do not confound the in-

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[5] Potential advances toward the solution to this problem are being made in the experimental economics literatures (e.g., Forsythe et al. [1982] and Plott and Sunder [1982]). However, extant experimental economics results cannot be linked easily to market-based accounting research.

[6] See Beaver and Demski [1979] for a discussion of this point.

[7] The rational expectations literature (see, e.g., Grossman [1976] and Grossman and Stiglitz [1980]) provides examples of market equilibria under incomplete markets, but "accounting" does not typically arise endogenously.

[8] Beaver [1987] makes explicit the notion that cross-sectional residual analysis is analogous to estimation of a two-factor return regression in which the market return and earnings changes appear as two separate factors. In fact, if linearity is assumed, the two procedures are econometrically equivalent.

> ference that *some measure* of earnings is related to prices.[9]

It is unclear whether these assumptions are better or worse than the assumptions required to justify empirical work outside of the market model-CAPM framework. Some of these alternative assumptions are developed in subsequent discussion.

The Returns Design and Deflation

Another potential advantage of a returns-based methodology is that a natural motivation for deflation of the variables in cross-sectional analyses is provided. We address three specific issues related to deflation.

First, the fundamental economic motivation for specifying a pricing relation in return form is unclear. Equilibrium pricing models typically assume models of utility maximization that relate to maximizing wealth (or value), not return. The return form may provide a convenient means to compare assets, but there is no inherent reason to characterize asset pricing in terms of a deflated price change. Given that the return is a derived metric and not a primitive economic concept, the most compelling motivations for using deflated price change models to conduct empirical work are statistical or econometric. That is, we may posit that the market model is a "good" pricing relation because of desirable statistical properties, e.g., residuals from market model regressions are serially uncorrelated. If the motivation is purely statistical, then the decision to use the market model to conduct empirical tests rather than a levels design with *ad hoc* deflators substitutes one form of *ad hoc* deflator for another. Given this interpretation, criticism of levels studies based on their use of *ad hoc* deflators is problematic.

Second, we might view deflation as a means for mitigating heteroscedasticity. Intuitively, this motivation is compelling; e.g., in regressions of equity value changes on earnings changes, we might expect IBM's residual variance to be substantially larger than Cray's simply because IBM is so much larger than Cray. To conduct appropriate hypothesis tests in the presence of heteroscedasticity, a standard approach is to deflate both the dependent and independent variables. We might, thus, view returns methodologies as adjusting for the heteroscedasticity inherent in cross-sectional analyses. If one adopts this view, two cautions are relevant. First, heteroscedasticity-motivated deflation calls for the scaling of all of the variables by the same deflator. In market model-based accounting studies, one can make an intuitive argument for deflating accounting variables by beginning equity value of the firm, given that the dependent variable is viewed as being deflated by the beginning market value of the equity[10] as championed by Christie [1987]. Second, if deflation is a means for dealing with heteroscedasticity, a more direct approach to testing market-based accounting theories may be to develop the theory without adopting the market model or any particular deflation scheme, and then using the rather formidable technology—of which deflation is just one technique—developed by econometricians for dealing with heteroscedasticity.

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[9] Obviously, the MBAR researcher needs to assume that either (1) the measurement error is minimal, or (2) the measurement error structure in the included variables can be characterized so as to permit inferences about specific regression coefficients.

[10] Note, though, that the interpretation of the market return in such a deflated regression is problematic. Why, for example, do we not deflate the unscaled change in value of the market portfolio by the beginning market value of the firm's equity?

Finally, note that even if we accept the market model as the maintained return-generating process, the issue of deflation is still vexing. To illustrate, consider the claim by Christie [1987] that the choice of deflator in returns studies is clear. Christie argues persuasively that all of the independent variables in residual cross-sectional regression models should be deflated by beginning market value of the equity—this being dictated by the researcher's decision to examine the unexpected return. The expression derived by Christie for the residual return makes no apparent reference to an asset pricing model, such as the CAPM. However, even the most primitive derivation of a representation of "unexpected" return requires one to specify a measure of investor expectations for future prices. Christie's simplified expression for residual return given by his equation (2.4) has some implicit asset pricing relation captured by "expected stock price," S_{t+1}, and "expected dividends," D_{t+1}.[11] A critical assumption in this argument is that the *definition* of rate of return allows for a separate analysis of numerator and denominator in terms of the unobserved expected future prices and cash flows (dividends). Such an assumption would be valid in accounting contexts if there were a mapping from the unobserved theoretical variables in equation (2.4) to observed accounting and non-accounting variables. Unfortunately, no known mapping exists. However, even if such a mapping exists, it is not obvious whether it preserves the property that the accounting and non-accounting variables that explain the residual return are also deflated by beginning of period equity market value. Appropriately defined, the observed accounting and non-accounting variables may not even require deflation.

Returns Designs and Differencing

Finally, consider the assertion that returns designs provide an implicit control for omitted variables in that all variables are differenced. That is, an advantage of the returns design (over a levels design) is that certain unmeasured variables are eliminated by the differencing. This issue is discussed along two dimensions. First, related to our primary underlying contention, we argue that the effectiveness of differencing is sensitive to the maintained hypothesis that the researcher imposes on the problem. Second, in the context of some specific assumptions, we make precise statements about the advantages and disadvantages of levels and differences designs in cross-sectional accounting research. In particular, we develop three examples to illustrate how particular problems suggest the use of a levels or a differences design. The absence of a dominant research design across the three examples emphasizes the difficulty of making general statements about the inherent advantages of a differences or levels approach. In a subsequent section, we tie them together with some extant cross-sectional capital market studies.

Differencing and Omitted Variables

Except in highly stylized settings, the capital markets researcher cannot construct a valid laboratory experiment in which only selected items are allowed to vary. Thus, even though the researcher may be able to measure the covariance of some of the underlying variables of a particular theory, inability to measure the complete covariance structure of all variables in empirical MBAR tests forces the researcher to assume away many problems.

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[11] Note that the way in which unexpected return is defined depends critically on several assumptions, some of which are explicitly stated and others which are not. The following assumptions are required to derive the unexpected return appearing in Christie's equation (2.4): (1) complete capital markets, (2) independence of past and future rates of return, and (3) constant expected rates of return. Complete markets are needed to use an additive representation of value, and independence of rates of return is needed to represent value in terms of *expected* cash flows (dividends) discounted by *expected* rates of return (see Beaver [1981, chap. 4]). Constant expected rates of return—the only assumption made explicitly—helps to simplify the final expression for unexpected return in equation (2.4).

Discussion of this problem is most typically structured in terms of "omitted variables." Consider the case in which abnormal returns are regressed on some measure of change in earnings to infer something about the relation between earnings and security prices. Because we cannot observe the underlying covariance structure of all variables in the economy, there is no way to determine if earnings changes are causing the security price changes, rather than some linear combination of variables that is correlated with changes in earnings. This problem arises even in those circumstances in which the researcher makes an explicit attempt to control for omitted variables. As an example, consider the use of matched (*ex post*) pair designs to control for omitted variables such as Ricks [1982]. The motivation for the use of the matched pair design is typically to control for variations in the independent variables that are not explicitly measured. However, the researcher using a matched pair design has no way of validating the *assumption* that the control works, because the underlying covariance structure of the variables is unobservable.

One can view the MBAR researcher as a "passive observer" incapable of overcoming the omitted variables problem (e.g., Kinney [1986, pp. 343-344]). In matched pair designs, the researcher picks a "matching" firm along a number of dimensions (e.g., size and β), but one which differs along the experimental dimension (e.g., whether a switch of inventory valuation policy occurred). However, the fact that the matched firms differ along the experimental dimension may prove that correlated variables are omitted from the analysis. If the firms truly matched, one could argue that the firms should have matched along the experimental dimension as well. Contrast this case with a true laboratory experiment, in which the subjects do not select into "control" and "treatment" groups. Although variables might be omitted from the analysis, the researcher is not forced to allow subjects to self-select into the groups, preventing an *ex ante* expectation that the selection will correlate with the experimental treatment. *Ex post* there may still be unobservable correlated omitted variables, but *ex ante* the researcher can be assured that subjects did not self-select along any dimension that correlates with the effect of interest.

As another example, in event studies a typical approach to the "confounding events" problem is to review the *Wall Street Journal Index* to determine events occurring contemporaneously with the event being studied. If confounding events are observed, observations are typically omitted from the analysis. Omitting the observation is an explicit means by which the researcher attempts to fix the variables not explicitly being varied. However, the researcher cannot completely control for confounding events, because the true covariance structure of the variables is unobservable. The researcher makes an *assumption* that the *Wall Street Journal Index* provides a sufficient control for the confounding effects of variables not explicitly fixed. Thus, the MBAR researcher makes an economically plausible attempt to control for omitted variables, and then makes an arbitrary assumption that the control works. Because such an assumption cannot be verified, we have no way of knowing about the validity of any set of assumptions about omitted variables.

We now turn to three examples to illustrate that the decision to estimate a cross-sectional relation in levels or changes form is driven by the set of economic and econometric assumptions that form the *maintained hypotheses*. In each of the examples, we assume that the deflation issue has been solved or does not exist, i.e., from the standpoint of efficiency, pooling of cross-sectional units (firms) is justified. We make this assumption so that we can focus on properties of the data that dictate either a levels or a returns approach.

Model 1: The One-Factor Model with Time-Specific Coefficients

Consider the following linear relation:

$$Y=\alpha+\beta_1 X \tag{1}$$

To give economic meaning to the model, we can think of Y as market value of shareholder equity, and X as a measure of earnings. This is basically the Miller and Modigliani [1966] valuation model, in which risk is captured by the coefficient, β_1. Suppose we wish to estimate the cost of capital for a set of firms in the same risk class, as was done in Miller and Modigliani.[12] We could obtain an estimate by pooling these firms in the following regression model:

$$Y_i=\alpha_1+\beta_1 X_i+\epsilon_i \tag{2}$$

where ϵ_i is a firm-specific value determinant unrelated to X_i. If the usual OLS assumptions are satisfied, then $\hat{\beta}_1$ would be an unbiased estimate of one over the cost of capital.

The relation given by equation (1) is not time subscripted. However, the model can hold at different points in time with shifts in relative risk. For a sample of firms in the same risk class, suppose that there is a shift in the cost of capital between two years. Call the year before the shift *year 1*, and the year after the shift *year 2*. We could obtain estimates of the cost of capital at the two points in time by estimating the following two regression models:

$$\text{Year 1: } Y_{1i}=\alpha_1+\beta_1 X_{1i}+\epsilon_{1i} \tag{3}$$

$$\text{Year 2: } Y_{2i}=\alpha_2+\beta_2 X_{2i}+\epsilon_{2i} \tag{4}$$

Is there anything to be gained (or lost) by pooling the two years of data in a *change* regression model? The change model is given by:

$$\Delta Y_i=\alpha+\beta\Delta X_i+\Delta\epsilon_i \tag{5}$$

where

$$\Delta Y_i\equiv Y_{2i}-Y_{1i},$$
$$\Delta X_i\equiv X_{2i}-X_{1i}, \text{ and}$$
$$\Delta\epsilon_i\equiv\epsilon_{2i}-\epsilon_{1i}.$$

If the sample errors from both periods are uncorrelated with both regressors, the OLS estimate of the slope coefficient, $\hat{\beta}$, is

$$\begin{aligned}\hat{\beta}=\;&\beta_2\Sigma(X_2-\bar{X}_2)^2+\beta_1\Sigma(X_1-\bar{X}_1)^2\\ &-(\beta_1+\beta_2)\Sigma(X_2-\bar{X}_2)(X_1-\bar{X}_1)\\ &/\Sigma(X_2-\bar{X}_2)^2+\Sigma(X_1-\bar{X}_1)^2\\ &-2\Sigma(X_2-\bar{X}_2)(X_1-\bar{X}_1).\end{aligned} \tag{6}$$

To gain intuition for the meaning of equation (6), note that if the sample variances of the regressors are the same, i.e., $\Sigma(X_{2i}-\bar{X}_2)^2=\Sigma(X_{1i}-\bar{X}_1)^2$, the estimated coefficient from the differenced regression will equal the average of the two individual β's, $(\beta_1+\beta_2)/2$. More generally, the observed regression coefficient would be a convex combination of the coefficients from the individual years, and the precise value of the observed coefficient would depend on the earnings variances and covariances. However, in the context of a study such as Miller and Modigliani [1966], it is not clear what the appropriate hypothesis test is for the difference regression given in equation (5), since the two different coefficients, β_1 and β_2, represent the inverse of the cost of capital at two different points in time. Miller and Modigliani were interested in the evolution of the cost of capital for their sample of electric utilities, not the average.

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[12] We define *risk class* as Fama and Miller [1972] do on p. 161 of their text. Essentially, two firms are in the same risk class if their state contingent cash flows differ by a constant proportionality factor in each state.

If we assume that the slope coefficient is intertemporally constant, then to determine whether the researcher is better off by differencing, the properties of the error terms in the differenced and the two levels regressions must be considered. Since the earnings terms in equations (3) and (4) represent "economic" earnings, it is important to note that the error terms in the regressions arise from components of equity value that the researcher *elects* not to measure as part of economic earnings. Further, these unmeasured components must be assumed to be uncorrelated with the variable that will represent "economic earnings" to apply conventional OLS inference techniques. If the residuals from a given firm do not covary over time, then differencing will introduce inefficiency, in that the residual variance from the differenced regression will be the sum of the two variances from the levels regressions. That is, if ϵ_{1i} and ϵ_{2i} are independent, then the variance of the error term in the difference regression in equation (5) will be the sum of the variances of ϵ_{1i} and ϵ_{2i}. In contrast, efficient, unbiased, and consistent estimates of the individual coefficients are obtainable without differencing. If the residuals are not independent across periods, then the problem is more complex (as well as more realistic). To keep the discussion parsimonious, we discuss this dependence in the context of the following measurement error example.

Model 2: The One-Factor Model with Systematic Measurement Error

Consider again the model given by equation (1). In contrast to what was assumed for Model 1, suppose that the relation is unchanging over time, i.e., $\alpha_1=\alpha_2$ and $\beta_1=\beta_2$. If this is true, then identical coefficients would be obtained by estimating equations (3) (or (4)) and (5).

Now suppose that we introduce measurement error into the basic model to motivate the case for differencing. One common criticism of accounting earnings is that it fails to include many off-balance sheet items that affect the value of the firm. With this in mind, suppose our empirical measure of earnings is accounting earnings. Let the "true" measure of earnings be equal to accounting earnings plus an additional time-invariant component:

$$X_{it}=X^a_{it}+c_i \tag{7}$$

where

X_{it} = the true earnings for firm i at time t,
X^a_{it} = the accounting earnings for firm i at time t, and
c_i = the systematic component of true earnings that is excluded from accounting earnings.[13]

Now, dropping time subscripts (since $\alpha_1=\alpha_2$ and $\beta_1=\beta_2$), if we estimate equation (3) using X^a_{it} instead of X_{it}, we have:

$$Y_i=\alpha+\beta X_i+\beta c_i+\epsilon_i. \tag{8}$$

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[13] An example of c_i might be the effect upon true earnings of some contingent liability (see our discussion of Texaco below). The absence of a time subscript on c implies its effect is time-invariant.

However, since c_i is assumed to be unobservable, βc_i is included as part of the *observed* error term. As a consequence, the OLS estimate of β will be biased and inconsistent with the direction of the bias determined by the correlation of c_i with X_i.

If we estimate the regression model in changes form, i.e., by estimating equation (5), we would have:

$$\Delta Y_i = \beta \Delta X_i^a + \Delta \epsilon_i \tag{9a}$$

$$= \beta \Delta X_i + \beta \Delta c_i + \Delta \epsilon_i \tag{9b}$$

$$= \beta \Delta X_i + \Delta \epsilon_i . \tag{9c}$$

Differencing eliminates the bias in our estimate of the slope coefficient by eliminating the effect of c_i, which can be thought of as a (possibly correlated) measurement error in the levels regression.

The measurement error model given by equation (7) can be stated more generally as a correlated omitted variable problem, i.e., where the "true" vector of explanatory variables consists of X and c, but we estimate the regression equation only with X. The general correlated omitted variable model allows for different coefficients for c and X instead of requiring each to have the same coefficient, β. That is, the true model may be given by:

$$Y_i = \alpha + \beta X_i + \gamma c_i + \epsilon_i . \tag{10}$$

As with the measurement error model, exclusion of c_i from the regression model given in equation (10) will cause the OLS estimator of β to be biased and inconsistent. In addition, estimation of equation (10) in differenced form eliminates the biasing effect of c on X's coefficient:

$$\Delta Y_i = \beta \Delta X_i + \gamma \Delta c_i + \Delta \epsilon_i \tag{11a}$$

$$= \beta \Delta X_i + \Delta \epsilon_i . \tag{11b}$$

If c_i is uncorrelated with X_i, then differencing may or may not be preferred. A comparison of the standard errors from equations (10) and (11b) may show a reduction in error variance due to differencing. To see this, assume that c_i, X_i, and ϵ_i are uncorrelated in a given sample. In the levels regression, the estimate of the error variance will include the cross-sectional variance of c_i as a component. If we approximate the sample error variance of period 1 by its true variance, $\sigma^2_{\epsilon_1}$, and the sample variance of c by its true variance, σ^2_c, the estimate of the error variance from the levels regression will be:

$$\textit{Error Variance} = \gamma^2 \sigma^2_c + \sigma^2_{\epsilon_1} . \tag{12}$$

Conversely, consider a differenced regression, in which the regression in equation (5) is conducted using data from periods 1 and 2. In the differenced regression, because the c_i term does not vary across periods, it is eliminated as shown in equation (11b). If the error variance of the differenced regression sample is approximated in terms of the true error variances in periods 1 and 2, the error variance of the differenced regression will be:

$$\textit{Error Variance} = \sigma^2_{\epsilon_1} + \sigma^2_{\epsilon_2} . \tag{13}$$

Preference of the form of specification would depend on which of the two error variances was smaller, since smaller error variances translate directly into an increased ability to reject an arbitrary null hypothesis.

To give this example more intuitive content, return to the measurement error model given by equations (7) through (9). Assume that a research design calls for a regression of prices on earnings or price changes on earnings changes with inferences to be based on the estimated regression coefficients. Suppose also that the study uses 1985 and 1986 accounting earnings and security prices for a set of firms, including Texaco as an observation. In December 1985, a Texas court awarded Pennzoil approximately $10 billion in damages relating to Texaco's alleged inappropriate behavior in its takeover of Getty Oil. Subsequent to the announcement of the damage award, Texaco's stock price declined significantly, suggesting that Texaco stockholders made some adjustment for expected liability from the lawsuit. However, in 1985 and 1986, the only accounting recognition Texaco made of the damage award was as a contingent liability.

Consider the Texaco observation in the context of the measurement error model given by equation (10). Although the Pennzoil suit damage award caused Texaco to sustain a decline in its "permanent earnings," X_i—causing a drop in its security price immediately after the damage award—its 1985 reported income failed to capture this decline. Because no cash had been paid to Pennzoil shareholders, we can think of the reported accounting income as being its *true* earnings and a constant "accrual component" (or an annual "loss reserve" adjustment) to Texaco's permanent earnings stream. That is, Texaco's reported earnings failed to contain a negative c_i term subsequent to the announcement of the damage award: the "economic earnings" term in equation (10), X_{it}, equals the reported earnings, X^o_{it}, plus a negative error, c_i, which is time-invariant by assumption (or in econometric terms, c_i is a "fixed effect"). If we now assume that there are many such firm-specific measurement errors entering into a cross-sectional levels regression such as equations (3) and (4), levels regression estimates of β will be biased. However, because the unmeasured component does not vary across time, differencing will eliminate the bias. In the context of the Texaco example, assume that no new information about Texaco's damage liability award surfaced in 1986. Estimating the model in differenced form (that is, using differenced 1985 and 1986 observations) will eliminate the biasing effects of the measurement error in Texaco's true earnings, X_{i}, *assuming that the measurement error in earnings is a fixed, time-invariant effect.*

It is important to note that differencing is a useful way to eliminate measurement error in earnings *only in years following the introduction of systematic measurement error in earnings.* For example, if price changes are regressed on earnings changes for oil and gas firms over the period during which Texaco's damage announcement occurred (1985), the earnings metric will not equal ΔX_i for Texaco. Instead, it will be equal to ΔX_i plus c_i, because Texaco's reported earnings does not contain the loss reserve component until 1985. Differencing to eliminate the c_i term is of questionable value in 1985, since it appears in both the differenced and undifferenced equations in that year.

The fixed effect measurement error structure captured by Model 2 may seem stylized. However, to see the model's potential relevance, consider the residual interdependencies observed in a number of levels studies. For example, Magliolo [1986] estimates a levels regression in which an estimated value of oil and gas reserves is regressed on an accounting measure of oil and gas assets to infer how well the accounting data explain statistically the values of oil and gas reserves.[14] Magliolo reports substantial residual dependencies from these levels regressions across years, if the residuals from firms are pairwise correlated across a given year.[15] It is routine to generate this type of residual dependency observed using the Model 2 framework. To see this, assume that equation (10) is descriptively valid, and that the model is estimated over successive years. A cross-sectional regression of the residuals from one year's levels regression on the residuals from a regression from the prior year, would yield a (possibly substantial) correlation induced by the time-invariant unmeasured value component (c_i) that is common across years in the *estimated* residuals. That is, c_i would be "buried" within the estimated errors, and differencing might eliminate this component.

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[14] Values of oil and gas reserves are inferred from the sum of the market values of all of the firms equities, less the values of any assets that are not oil and gas reserves. This same dependent variable was used in the Harris and Ohlson [1987] study described below.

Model 3: The One-Factor Model with Constant (Across Time) Coefficients and Unsystematic Measurement Error

This model is a variation of the measurement error model presented in several econometrics texts. Assume that equation (1) holds at all points in time, i.e., $\alpha_1=\alpha_2$ and $\beta_1=\beta_2$ as in Model 2. However, assume that the values of X are measured with error in the following way:

$$X^*_{1i}\equiv X_{1i}+\eta_{1i} \tag{14}$$

$$X^*_{2i}\equiv X_{2i}+\eta_{2i} \tag{15}$$

where the η_1 and η_2 are mean zero *iid* random variables (η_1 and η_2 need not be identically distributed). Equations (14) and (15) characterize the measurement error in a simple additive form.

Now, assume that we estimate β_1 by regressing Y_{1i} on X^*_{1i} instead of X_{1i}.[16] If we assume that $\text{cov}(\epsilon_1,X_1)=\text{cov}(\eta_1,X_1)=\text{cov}(\eta_1,\epsilon_1)=0$, the probability limit of $\hat{\beta}_1$, plim $\hat{\beta}_1$, is given by

$$\text{plim } \hat{\beta}_1=\beta_1\{1\}/\{1+[\text{var}(\eta_1)/\text{var}(X_1)]\} \tag{16}$$

where $\text{var}(\eta_1)$ is the variance of η_1 and $\text{var}(X_1)$ is the variance of X_1 [Johnston, 1972, pp. 281-282].

Now assume that the model is estimated in difference form, i.e., Y_2-Y_1 is regressed on $X^*_2-X^*_1$. If we add several assumptions similar to those used to derive the measurement error result given by equation (16), it is routine to show that[17]

$$\text{plim } \hat{\beta}_1=\beta_1\{1\}/\{1+[\text{var}(\eta_1)+\text{var}(\eta_2)-2\text{cov}(\eta_1,\eta_2)]/[\text{var}(X_1)+\text{var}(X_2)-2\text{cov}(X_1,X_2)]\}. \tag{17}$$

Is any advantage afforded by estimating the model in differenced form? Examination of equations (16) and (17) shows that the answer depends on the relative effects—magnitudes and signs—of $\text{cov}(\eta_1,\eta_2)$ and $\text{cov}(X_1,X_2)$, and the relative magnitudes of the variance of the X's and the η's. For example, if $\text{cov}(\eta_1,\eta_2)$ is positive and of the same order of magnitude as $\text{var}(\eta_1)$ and $\text{var}(\eta_2)$, then estimating the model in difference form may tend to reduce the bias in the estimate, $\hat{\beta}_1$. However, if $\text{cov}(X_1,X_2)$ is positive and of the same order of magnitude as $\text{var}(X_1)$ and $\text{var}(X_2)$, then estimating the model in difference form may tend to accentuate the bias.[18] That is, differencing could induce a greater bias than if the model were estimated in the levels.

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[15] That is, if ϵ_{it} is the regression residual for firm i in year t, the sample correlation for years t and $t+1$ would be $\Sigma_i(\epsilon_{i,t}\times\epsilon_{i,(t+1)})$.

[16] Because $\beta_1=\beta_2$, the following argument can be stated equivalently in terms of year 2 instead of year 1.

[17] In particular, in addition to the assumptions required to derive equation (16), the following assumptions are required to derive equation (17): (1) $\text{cov}(\epsilon_2,X_1)=0$, (2) $\text{cov}(\epsilon_1,X_2)=0$, (3) $\text{cov}(\eta_2,X_1)=0$, (4) $\text{cov}(\eta_1,X_2)=0$, (5) $\text{cov}(\eta_1,\epsilon_2)=0$, and (6) $\text{cov}(\eta_2,\epsilon_1)=0$.

[18] Suppose $\text{var}(\eta_1)=\text{var}(\eta_2)=\text{cov}(\eta_1,\eta_2)$. Then, the bias in $\hat{\beta}_1$ will be asymptotically zero. Suppose instead that (1) $\text{var}(X_1)=\text{var}(X_2)$, (2) $\text{cov}(X_1,X_2)=\alpha\ \text{var}(X_1)$ (with α "near" but less than one), and (3) $\text{var}(\eta_1)+\text{var}(\eta_2)-2\text{cov}(\eta_1,\eta_2)=m$ (where m is an arbitrary positive number), then plim $\hat{\beta}_1$ will be "close to" zero.

Note that the "preferred" bias will depend upon the particular research question. For example, if the researcher wishes to demonstrate that accounting earnings is a poor proxy for "true" earnings (X_1), then estimating the model so as to accentuate the bias in $\hat{\beta}_1$ (using either levels or differences) may be preferable. Thus, bias is not necessarily undesirable. In contrast, if the goal is to assess the statistical significance of $\hat{\beta}_1$, then estimating the model so as to eliminate bias is preferable. However, it should be clear that no obvious advantage is afforded by a levels or differences approach without specifying a particular research context. This means, of course, that the researcher must have particular knowledge of the nature of measurement error in the regression variables in order to select the appropriate model specification.

Model 3 can be used to make at least two important observations. First, Christie [1987, pp. 249–250] observes that a problem with levels studies is that any variable correlated with size will be significant in regressions of equity values on accounting variables. To use his example, assume that equity values are regressed on depreciation in levels. Intuitively, a significant coefficient from such a levels regression might be observed because depreciation measures economic earnings (X_t) with error (i.e., "big" depreciation implies "big" X_t), but the error is not large enough to drive the observed coefficient to zero.[19] Now consider a regression of value changes on depreciation changes. If the measurement errors induced by measuring X_t as depreciation are not highly intertemporally correlated, then in the context of equation (17), differencing may have the effect of increasing the relative amount of measurement error. This will almost certainly be the case if the magnitude of the covariance in economic earnings is of the same order of magnitude as its variance. Comparing equation (16) to equation (17), differencing may accentuate the bias and drive the observed coefficients on depreciation towards zero.

Second, Model 3 may give some insight into why levels coefficients for regressions of equity value on earnings are so large relative to the values in changes regressions. Bowen [1981] observes coefficients on earnings that approximate one over the risk-free rate of interest. In contrast, consider some results of Beaver and Landsman [1983], who cross-sectionally regress percentage price changes on percentage earnings changes. If we assume that equity value is approximately the "permanent" earnings (X_t) divided by the discount rate, ignoring measurement errors, one can make the argument that Beaver and Landsman should have observed coefficients that were close to one. To see this let

$$\Delta Y_t = p\Delta X_t$$

where p is one over the discount rate and the relation is derived from the primitive relation in levels, and ΔX_t is the change in permanent earnings at time t. If we divide the left-hand side and the right-hand side by beginning-of-period value, we obtain[20]

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[19] Note that, in contrast to Christie [1987], we do not necessarily view the correlation of depreciation with equity values in a negative light. Because economic earnings (X_t) are unobservable, it is not immediately clear that any instrumental variable (i.e., any variable correlated with earnings) should be ruled out as a potential measure of X_t. In Christie's example, accentuation of the bias is preferable because the correlation of depreciation with earnings is viewed as potentially harmful. Presumably, rejecting the null hypothesis that β equals zero is undesirable because the researcher is then assumed to accept the alternative that depreciation "causes" security prices rather than earnings. In this context, rejection of the null hypothesis is spurious. However, note that other alternative hypotheses could be specified, in which rejection of the null hypothesis does not automatically imply the conclusion that depreciation is "economic earnings."

$$\begin{aligned}\frac{\Delta Y_t}{Y_{1t}} &= \frac{p\Delta X_t}{Y_{1t}}\\ &= \frac{p\Delta X_t}{pX_{1t}}\\ &= \frac{\Delta X_t}{X_{1t}}\end{aligned}$$

That is, the predicted coefficient would have been close to one, and yet Beaver and Landsman could reject the null hypothesis that their coefficients were equal to one at extremely high confidence levels. In the context of equation (17), assume that essentially all of the changes in earnings in a given year were "temporary," and that the accounting earnings used in the data analysis correctly measured economic earnings except for the temporary effects picked up in year 2; i.e., only the variance of η_2 will be non-zero. For a given level of measurement error, in the limit the denominator of the "main" fraction in equation (17) can be made arbitrarily large if the covariance of X_1 and X_2 increases enough, and the OLS estimator of β_1 will be driven to zero.

III. Model Specification and Prior Studies

The three models presented in Section II contrast the appropriateness of estimating a particular cross-sectional model in price levels and changes form. The purpose of the discussion was to provide a clear linkage between model choice (functional form) and the maintained economic and econometric relations. In this section, we provide conjectures regarding the appropriate functional form for a handful of studies in the extant literature. Our purpose is not to suggest whether the authors were correct or not in their choice, but rather to illustrate how particular issues in such studies potentially suggest an appropriate functional form.

One study which was perhaps best estimated in price levels form is the pension valuation study of Landsman [1986]. Landsman specifies an asset pricing relation between equity market values and pension and non-pension assets and liabilities. Given this relation, he estimates his cross-sectional model in price-levels form. An important issue in the study is measurement error in the pension variables. What might have happened if the model were estimated in price change form? In particular, might measurement error bias have been reduced or exacerbated? Evidence is provided in Landsman [1984]. There, he provides coefficient estimates for his model estimated in percentage change form. The findings suggest that differencing only exacerbated bias, as the pension coefficients both dropped toward zero. Differencing appeared to produce a situation where the transformation yielded variables dominated by measurement error. That is, the situation of equation (17) in Model 3 obtained, where the covariance of the pension variables across two years approximately equalled the variances within each year. This permitted measurement error to dominate and push the pension coefficients towards zero.[21]

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[20] Beaver, Lambert, and Morse [1980] motivated the construction of percentage change regressions using similar reasoning. They regressed percentage price changes on percentage earnings changes, using the division by prices and earnings to account for cross-sectional differences in the discount factors. That is, they did not assume that p was the same for all firms, and used the division to eliminate the cross-sectional dispersion in the coefficients.

Consider, also, some recent research examining the relation between the values of firms' oil and gas accounting data and selected security market variables. Harris and Ohlson [1987] estimate a set of levels regressions to examine the incremental explanatory power of various data disclosed in oil and gas financial statements. In particular, the authors estimate a series of regressions that may be conceptually described as follows:

$$\text{Values of Oil \& Gas Reserves} = a + b[\text{Historical Cost Asset Values}] + c[\text{RRA Data}]$$

where Historical Cost variables represent the values of oil and gas assets carried on the financial accounting books and the RRA (Reserve Recognition Accounting) data variables represent valuations of firms' oil and gas reserves calculated according to rules specified by the SEC.[22] Their dependent variable is the same as that of Magliolo [1986]. Harris and Ohlson make interpretations of their results that are very similar to those made in the "incremental information content" replacement cost papers (e.g., Beaver and Landsman [1983] and Bublitz et al. [1985]). That is, given one set of variables, does a variable (or set of variables) add information, in the sense that its regression coefficient is statistically significant? Inferences are drawn based on t-tests where the null hypothesis is that the coefficient in question is zero.

In contrast, Doran et al. [1988] correlate changes in the RRA values and historical cost earnings with cumulative abnormal residual security returns, where the residual returns are defined in terms of the market model. The authors regress the cumulative abnormal returns on deflated changes in historical cost earnings and deflated changes in components of "earnings-like" figures calculated from the SEC data. At a broad level, the authors' basic purpose can be interpreted as similar to that of Harris and Ohlson: do the RRA data "add incremental information" to historical cost data in the explanation of security market variables (and vice versa)?

Not surprisingly, the "preferred" approach for estimating the relation between security prices and RRA data depends on the particular context. If one believes that our Model 1 is descriptive (i.e., that the levels coefficients vary through time and the residual errors are independent), the levels approach of Harris and Ohlson might be preferred. Their historical cost variable coefficients do vary intertemporally through time in a nontrivial way, suggesting that a constant coefficient assumption might be violated.[23] Assuming that the coefficients do vary through time, consider a set of differenced regressions in the context of our Model 1. The motivation for differencing is unclear, since under the Model 1 assumptions, appropriate estimates could be obtained without the differencing with smaller standard errors. Further, in the context of our Model 3, note that at least some of Harris and Ohlson's independent variables varied only slightly over time, suggesting that the "true" value measures (i.e., the values measuring the true variables without error) have high covariance. At the extreme, assume that the covariance of the true measures is almost perfect. While care must be exercised extending our two variable results to the multivariate case, less than extreme covariance in the measurement errors across periods could result in extreme bias of the coefficients if their model were estimated in differenced form.

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[21] Alternatively, it is, of course, possible that differencing "eliminated" the biasing effect of measurement error as in Model 2, where the true relation between the pension variables and market value was zero. That is, measurement error bias could have accounted for the observed non-zero relation between the pension variables and market value in the levels.

[22] Reserve Recognition Accounting is a method of accounting for oil and gas firms that bases asset values and income measurement on estimated values and changes in values of oil and gas reserves. Under the method, firms would recognize income when oil and gas is discovered, or when sale prices of the reserves change. Although the SEC has disclaimed such a purpose for RRA data, one may think of the method as attempting to base the accounting on market valuations of the oil and gas reserves.

[23] The coefficients vary in an economically (if not statistically) significant way, but no formal comparisons of the different levels coefficients are presented.

Conversely, what assumptions would argue for the returns approach of Doran et al.? Again, with the appropriate *caveats* for extending the two variable results to the multivariate case, consider the returns approach in the context of Model 2. Suppose that the earnings terms are systematically mismeasured in the sense that each earnings figure is in error by a time-invariant amount for each firm. That is, accounting earnings mismeasures the economic earnings that the researchers would like to measure (or $X_{it}-X^a_{it}=c_i$ as in equation (7)). Ignoring changes in coefficients, estimating the model in levels will introduce bias in the coefficients, suggesting that the returns approach of Doran et al. is dominant.

If equation (7) is descriptively valid and the measurement error issues in Model 3 can be ignored, then whether or not to difference becomes an empirical question. Miller and Upton [1985] regress the same dependent variable as the one used in the Magliolo and Harris and Ohlson studies on an alternative measure of the oil and gas asset values of firms. Miller and Upton report estimates of the residual variances for regressions conducted both in levels and in differences. The estimated standard error of their differenced regression is larger than that of their levels regression, suggesting that the power of their tests is not increased by differencing. In the context of equations (12) and (13), the reduction in the time-invariant error was swamped by the addition of the "true" error from the second period. Note that the relatively crisp interpretations provided here by the discussion of omitted variables in Model 2 (i.e., use levels or differences depending on which technique gives the lowest standard error) require that we be able to ignore the measurement error issues raised in Model 3. Note also that this comparison hinges on the assumption that the "true" residuals are independent. In contrast, Christie [1987] cites evidence from the Bowen [1981] study suggesting that the standard errors are understated due to dependence in the residuals. In particular, the time series of the coefficients from the levels regressions exhibit a larger standard deviation than would be expected given the levels estimates of the standard errors. Such an observation is consistent with cross-sectional dependence in the residuals within a levels regression. Whether residual dependence is a dominant concern in Bowen's study is not clear-cut, because an alternative explanation for the variation in coefficients is simply that the coefficients change through time. Christie's conclusion based on the comparison of the standard error estimates and the standard deviation requires that the coefficients be the same in all periods.

IV. SUMMARY AND CONCLUSIONS

In this paper, we have suggested three compelling reasons for conducting cross-sectional accounting capital market studies using a returns-based design in lieu of a levels-based design. However, the advantages afforded by the returns approach do not generalize across all sets of assumptions regarding asset pricing relations and econometric properties of the data used in the research. We have argued that the advantages of one approach over the other are largely dictated by what the researcher wishes to assume. Also, we noted that while the conventional market model framework offers solutions to particular *assumed* research design problems, we have no way of knowing whether these assumed design problems exist, or if they are of "first-order" importance. That is, because of our inability to examine scientifically our maintained assumptions, our ability to make claims about inherent advantages of almost *any* methodology is premature.

The examples and interpretations in Sections II and III are a modest attempt at formalizing the choice between a levels and changes design without adopting a changes methodology *ex ante*. Given our historical perspective, the development of cross-sectional capital markets research around the market model is not surprising. As we noted, the market model can be connected to the solution of particular econometric problems, e.g., omitted variables and heteroscedasticity and to the formal inclusion of uncertainty. However, given (1) the rather tenuous connection between the market model and equilibrium asset pricing theory and (2) the market model's inability to solve *all* relevant econometric problems, an assumption that returns designs always work best may be premature.

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Underpricing of New Issues and the Choice of Auditor as a Signal of Investment Banker Reputation

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ABSTRACT: A theoretical model that explicitly incorporates the relation between investment banker and auditor is developed to provide a framework for testing the effect of auditor selection in the initial market for unseasoned equity issues. The theoretical model generates a number of testable propositions. Consistent with stylized facts, the theory suggests that high reputation investment bankers will more frequently use high reputation auditors, and that both investment banker and auditor reputation help to reduce underpricing. As either reputational variable increases, the model predicts that the impact of the other variable will diminish. The empirical results confirm this more complex relation. The structure of the model documented in this research may explain the difficulties of previous studies in identifying an empirical relation between auditor reputation and underpricing.

A NUMBER of recent studies have addressed various aspects associated with the pricing of new issues (see Smith [1986] for a survey). Underpricing, or a negative difference between a new issue's offering price and the first bid, has also been studied. For example, Miller and Reilly [1987] find an average underpricing of about ten percent.

The current study focuses on the interaction between the investment banker and the selection of an auditor in relation to the underpricing phenomenon. A theoretical model is derived in the context of the asymmetric information environment described by Rock [1986] and Beatty and Ritter [1986]. The model is developed from the perspective of a profit-maximizing investment banker where the reputation of the auditor has divergent effects on uncertainty of information. The model generates unique propositions concerning the interaction of investment banker and auditor repu-

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tation. Empirical tests on a sample of 1,182 initial public offerings during the 1981–1985 period support each of the model's propositions.

In Section I a brief review of prior theoretical models and empirical tests is presented. In Section II the theoretical model and its testable implications are derived. Section III describes the data set used for empirical tests. The propositions generated from our theoretical model are tested in Section IV and concluding remarks appear in the final section.

I. PREVIOUS RESEARCH

Theoretical Models of the Placement Process

A variety of theoretical models have been proposed to characterize the initial public offering phenomenon. Rock [1986] and Beatty and Ritter [1986] focus on the observed phenomenon of underpricing by investment bankers. Rock develops a model of the placement process in which there are two types of market participants: informed and uninformed. To insure sufficient demand for a new security, Rock's model posits that investment bankers must maintain an equilibrium level of underpricing. Equilibrium underpricing maintains demand by assuring uninformed investors that they will not be victims of the "winner's curse"—i.e., the case where their demand is fully satisfied only if the initial return is nonpositive. Beatty and Ritter extend Rock's model and show that underpricing should be related to the level of *ex ante* uncertainty.

In another line of research focusing more on the valuation of the new issue, signaling models are used to examine the asymmetry of information between the owner and the investor. Leland and Pyle [1977] consider the proportion of ownership retained by the original entrepreneurs as an important signal to market participants, with empirical evidence supporting this hypothesis provided by Downes and Heinkel [1982]. Ritter [1984a] subsequently shows that the empirical results are also consistent with an agency relationship or a wealth effect hypothesis. Baron [1982] concentrates on the informational advantage of the investment banker over the firm. Hughes [1986] provides a general characterization of the relation between the firm, investment banker, and investors in a bivariate signaling model.

The current study uses the asymmetry of information between uninformed and informed investors in Rock's model to motivate a signaling model where investment bankers can signal their reputation through the reputation of the auditing firm participating in the underwriting coalition. This signal will, in turn, affect the equilibrium level of underpricing.

Studies Incorporating Auditor Selection

Relatively few studies of initial public offerings have specifically incorporated the impact of auditor selection. Titman and Trueman [1986] develop a model that delineates the owner's incentive to signal through the quality of the investment banker or auditor selected for the issue. Their model shows that an owner with favorable information about the firm can convey this information to the market through the quality of the investment banker or auditor and thereby positively affect value (note that they focus on valuation and not underpricing). The model can be applied separately to either the selection of investment banker or auditor, but does not allow for interaction between the two. As will be discussed later, in practice the selection of auditor is not independent from the choice of investment banker.

Simunic and Stein [1987] examine product differentiation of auditors in the new issue market. They provide empirical support for the proposition that auditor reputation is not homogeneous. Their theory of audit quality predicts a direct relation between auditor reputation and initial value. This hypothesis is not supported in an earnings multiple model; however, it is supported in an equity multiple model. Additionally, their model suggests a linkage between auditor selection and investment banker reputation, although the selection process is couched in terms of the firm's managers.

Beatty [1986] provides an empirical study of the relation between underpricing and auditor selection. He identifies a number of differences between new issues associated with Big Eight versus non-Big Eight firms. For example, Big Eight clients disclose fewer uses of funds, fewer risk factors, and tend to have a shorter registration period. As noted by Beatty, most of his tests are based on conjectures from theoretical models that do not specifically account for the role of the auditor in the placement process. He is unable to consistently document a significant relation between auditor reputation and the underpricing of new issues.

II. A THEORETICAL MODEL OF AUDITOR CHOICE BY INVESTMENT BANKERS

In this paper, we concentrate on the interaction between the investment banker and auditor. In practice, the investment banker frequently determines auditor selection either through tacit approval of the firm's current auditor or by requesting auditor change. Thus, we derive a model from the perspective of the investment banker where the reputation of the auditor affects the signaling environment. The empirical results of Beatty [1986] indicate that auditor reputation is either only marginally related to underpricing or that a simple model based on *ex ante* uncertainty does not sufficiently describe the process. Our theoretical model generates a series of empirically testable propositions. The model suggests, and the empirical results support, a signaling environment where auditor reputation is important but is not related to underpricing in a simple unidimensional fashion.

Auditor Selection and Auditor Reputation

There are two fundamental assumptions we make with respect to the audit firm.[1] Both are consistent with previous theoretical and empirical results.

First, since our model is developed from the perspective of a profit maximizing investment banker, we assume that the investment banker explicitly or implicitly makes a decision about the auditor retained in the initial coalition. This decision can occur implicitly by accepting the existing auditor of the firm or explicitly by requesting an auditor change. Both the issuing firm and the investment banker have a vested interest in the selection decision; however, Simunic and Stein [1984] argue that the optimum choice of audit quality, if managers and underwriters were to select independently, should be consistent between the two groups. The investment banker, wanting to preserve its reputation capital, prefers a high quality auditor to assimilate and verify financial information in the issuance process and, thus, help prevent mispricing of the issue. Accordingly, we view the investment banker as selecting the auditor and indirectly compensating the firm in part for the excess cost of hiring a high reputation auditor. The auditor plays a passive role, attesting to the earnings estimate which is in no way influenced by the reputation of the investment banker.[2] Carpenter and Strawser [1971] and Arnett and Danos [1979] provide evidence that auditor change frequently occurs when a firm goes public and that the investment banker in many cases instigates the change. Simunic and Stein [1987] also cite anecdotal support for auditor change as a result of pressure from underwriters (see "Small CPA Concern Sues an Underwriter Over Loss of Client," *Wall Street Journal* [July 18, 1983, p. 1]). Note that we are not suggesting that investment bankers always select an issuing firm's auditor. The firm frequently has already made this choice and obviously has their own agenda for such selection. However, the investment banker subsequently decides whether this auditor is acceptable for taking the firm public.[3]

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[1] Throughout the paper, we consider only the case in which the underwriting contract is a firm commitment.

Second, we differentiate audit services using the usual Big Eight and non-Big Eight classifications. The role of the audit firm in our model is based on the effect of auditor reputation on perceived investment banker reputation, and the ability of the auditor to affect *ex ante* uncertainty. The assumption that a Big Eight auditor will serve to reduce *ex ante* uncertainty about the issuing firm's earnings is consistent with a number of general theories of auditor selection. DeAngelo [1981] argues that in order to maintain their investment in reputation capital, Big Eight firms will provide higher quality services. Alternatively, Healy and Lys [1986] suggest that auditor size and audit quality are not necessarily related. They indicate that the Big Eight firms can be differentiated through specialized services they can provide (e.g., SEC reporting in this case). More notably, the Big Eight firm's larger investment in reputation implies that investors will be able to more readily assess auditor quality and that there will be a more consistent realization of contracted-for quality. In the DeAngelo scenario, Big Eight auditors are assumed to provide higher quality and, thus, should provide a more precise estimate of earnings. In the Healy and Lys theory, investors would be more certain of the contracted quality because of the Big Eight auditor's higher potential of reputation loss. More closely related to the current study, Simunic and Stein [1987] model the problem of auditor choice in the context of product differentiation, where a key characteristic is "the credibility, reputation, or brand name of the auditor [p. 5]." They emphasize that, since credibility is an important attribute, auditor displacement at the time of a new issue does not necessarily occur because a smaller audit firm is technically incapable. Although these three general theories of auditor selection offer different decision scenarios, they each describe an environment consistent with our classification scheme where Big Eight auditors will tend to reduce *ex ante* uncertainty through their assessment of an issuing firm's earnings.

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[2] In principle, the issuance process can be described completely only if the underlying forces that lead to a certain coalition of investment banker, firm, counsel, and auditor are fully characterized in relation to the investor. The complexity of multivariate signaling models and our focus on the interaction between investment banker and auditor in pricing the new issue make an exhaustive characterization impractical. For example, we do not consider the incentives that investment bankers or auditors might have for specializing in a particular type of firm. This issue will not affect our analysis provided that investment bankers or auditors with a specific reputation level do not all specialize in the same type of firm.

[3] As additional anecdotal evidence, we interviewed a managing director at Goldman Sachs who stated that the reputation of a firm's auditor was one of several items critical in deciding whether to accept a firm as a client. He said that in almost all cases, Goldman Sachs will ask a firm to switch to a Big Eight auditor if they do not already employ one.

The Model

We begin by assuming an environment similar to that of Rock [1986] and Beatty and Ritter [1986]. We assume an investment community consisting of informed investors and uninformed investors. All agents are taken to know the structure of the investment banker's model, but informed investors have an advantage over uninformed investors by knowing the market value of the shares to be issued and the (actual) reputation of the investment banker. Also, the issuing firm and the investment banker have an informational advantage over uninformed investors in knowing the investment banker's actual reputation. As discussed in the previous section, the differentiating aspects of audit services are assumed to be captured in the Big Eight versus non-Big Eight classification. All market participants are assumed to perceive this distinction without error.[4]

The coexistence of informed and uninformed investors implies, as shown by Rock, that the uninformed investors are subject to a winner's curse so that they will only subscribe to a particular investment banker's offering if that investment banker, on average, underprices its offerings. Beatty and Ritter then obtain two important results. They show that an underpricing equilibrium is maintained since investment bankers will lose potential investors if underpricing is too little, or will lose issuers if underpricing is too much, thus, forfeiting the value of their reputation capital. Second, they show that the equilibrium degree of underpricing is positively related to *ex ante* uncertainty.

A basic model can now be developed for the investment banker's actions that incorporates the Beatty and Ritter results and focuses on the issues at hand—pricing and the investment banker's auditor preference. Since the investment banker can spread risk over a syndicate, we assume risk neutrality. In the context of the problem, we specify a profit function where the investment banker's proceeds are a result of three general components: (1) the uninformed investors' perception of the investment banker's reputation, (2) a basic fee that is tied to actual reputation minus a penalty, also related to actual reputation, that is a result of any deviation from the equilibrium level of underpricing, and (3) a cost of acquiring auditor reputation. The motivation for this specification is elaborated in the subsequent derivation of the complete model.

An investment banker is to select the offer value of an issue (offer price times the number of shares issued, denoted as p) and auditor reputation (A) so as to maximize expected profits (Π) given by:

$$\max_{p,A} \Pi(p,A) = \max_{p,A} \,[bR(A) + R'\cdot\{f - gE[u-(v-p)]^2\} - cA], \tag{1}$$

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[4] We subsequently test the sensitivity of our empirical results to this classification scheme by excluding the "middle group" of auditing firms from the sample (the second seven of the largest 15) [Simunic and Stein, 1987, p. 27], and separately, testing auditor fees as an alternative measure of auditor reputation. The assumption that all market participants perceive auditor reputation without error is for simplification, implying that investment banker reputation is less easily observable to uninformed investors than is auditor reputation. To motivate this assumption, we argue that mistakes by auditors are directly observable and attributable to the auditor, whereas the investment banker may not be judged as easily. However, our results are theoretically robust in the sense that even if auditor reputation is observed with error (including when the error is greater than that associated with observing investment banker reputation), then the auditor selection will still provide a signal—although noisy—about the investment banker's reputation.

where

$R(A)$ = the investment banker's reputation (a function of the auditor's reputation (A)) as perceived by uninformed investors,
R' = the actual reputation of the investment banker,
u = the equilibrium level of underpricing, as in Beatty and Ritter,
v = market determined value of the offering, with $E(v) = \mu$,

and b, c, f, and g are constants. The first term in the right-hand-side of equation (1) represents the ability of the investment banker to benefit the firm by signaling its reputation through auditor selection. This works through the effect of perceived reputation on *ex ante* uncertainty which in turn affects underpricing. The second term reflects a basic fee, f, tied to the investment banker's actual reputation, R', minus the loss in goodwill, also proportional to R', due to mispricing of the new issue. Consistent with Beatty and Ritter, investment bankers who miss the underpricing equilibrium will lose either potential investors if they do not underprice enough, or issuers if underpricing is too large. Accordingly, we represent the goodwill costs by a quadratic loss function that penalizes the investment banker for any deviation from the optimal level of underpricing. Clearly, an investment banker with higher reputation has more goodwill to lose so that the loss in goodwill can be considered proportional to reputation. For $u-(v-p)<0$ the investment banker loses goodwill with potential issuers who know R'. Likewise, for $u-(v-p)>0$, there is a goodwill loss to currently informed investors who also are assumed to know R'.

The third term in equation (1) represents the investment banker's cost of assuring himself or herself of a high reputation auditor. The investment banker is assumed to pressure the firm to hire a reputable auditor, which is in the banker's own interest since better information about earnings makes it easier for the investment banker to price correctly and maintain reputation capital. To the extent that investment bankers benefit, they should implicitly or explicitly pay for part of the reputable auditor's incremental cost.[5]

Uncertainty in the information environment is structured relative to underpricing so that the percentage underpricing is proportional to *ex ante* uncertainty, i.e.,

$$u/p = h(\sigma_v^2 + \sigma_m^2), \qquad (2)$$

where

h = the increase in the optimal percentage underpricing per unit increase in *ex ante* uncertainty,
$\sigma_v^2 = a(\bullet) - \ell n A$,
$\sigma_m^2 = r(\bullet) - \ell n \mathbf{R}$,
a = the exogenous part of the uncertainty attributable to the firm,
r = the exogenous part of uncertainty attributable to the market environment,

with $\mathbf{R} = R(A)$ when uninformed investors are evaluating the model, and $\mathbf{R} = R'$ for the informed investors, investment banker, and issuing firm. We adopt the Beatty and Ritter result that the equilibrium percentage underpricing is positively related (we assume proportional) to the level of *ex ante* uncertainty. The *ex ante* uncertainty, as specified in equation (2), is attributed to two independent sources. The first source of uncertainty, σ_v^2, is solely due to firm-specific factors—$a(\bullet)$, which is determined by factors exogenous to this model, and a term that reduces σ_v^2 based on the reputation of the auditor chosen. The logarithmic form of the latter relation accounts for diminishing returns to information acquisition. The second source of uncertainty, σ_m^2, captures uncertainty due to the market environment. Similar explanations can be provided for the composition of market uncertainty, σ_m^2, which consists of the exogenous part $r(\bullet)$ and a part that depends on the investment banker's reputation as perceived by uninformed investors. The uninformed investors' perception of investment banker reputation will be shown to depend on the choice of auditor. The auditor reputation variable, therefore, plays two important roles in the model: (1) the reduction of uncertainty concerning the measure of firm-specific value, and (2) the reduction of perceived uncertainty that results from the signal generated by the reputation of the auditor selected.

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[5] Simunic and Stein [1984, p. 20] provide evidence that underwriters make side payments to issuing firms to "induce the purchase of higher audit quality level." As subsequently detailed, audit reputation is measured with a binary variable for Big Eight auditors. Francis and Stokes [1986] and Palmrose [1986] find that Big Eight fees are higher than non-Big Eight fees for "small" clients (Palmrose defines small as total assets of less than $150 million). The majority of firms in our sample, being new issues, are relatively small. To test the sensitivity of our results, the empirical tests were repeated excluding all firms whose offer size was greater than $50 million. This had no effect on the sign or significance of any of the variables tested.

Additionally, we assume that the measures for investment banker and auditor reputation are strictly positive. For consistency, since *ex ante* uncertainty approaches infinity as lim $\mathbf{R}\rightarrow 0$, A is chosen such that lim $A\rightarrow 0$ as $\mathbf{R}\rightarrow 0$. That is, as $\mathbf{R}$ approaches zero, the investment banker will optimally choose A at its lowest possible level since it is impossible to reduce uncertainty below infinity (a further motivation for an initial condition such as this appears in Riley [1975]). There must also be an upper bound to auditor and investment banker reputation to insure that σ_v^2 and σ_m^2 remain positive.

Optimization

Consider the optimal pricing of the issue (p^*) to be determined by the investment banker. The first order condition for equation (1) with respect to p is:

$$\begin{aligned}\partial\Pi/\partial p = -2gR'[1+h(\sigma_v^2+\sigma_m^2)]\bullet \\ E[u-(v-p)]=0, \qquad (3)\end{aligned}$$

which implies that:

$$p^* = \mu - u. \qquad (4)$$

Some additional results are revealed by equations (3) and (4). First, note that the investment banker cannot signal with the value of the offering (p) since $\partial^2\Pi(p^*,A)/\partial p\partial R' = 0$. That is, a necessary condition for a signaling equilibrium, as identified by Spence [1973], fails with respect to price, since a higher reputation for the investment banker is not related to the investment banker's optimal pricing decision. Second, since uninformed investors know the structure of the model they know from equation (4) that $\mu = p^*[1+h(\sigma_v^2+\sigma_m^2)]$. Once σ_v^2 and σ_m^2 are revealed—as subsequently will be demonstrated—μ can be correctly inferred from observation of p^*.

Next consider the effect of auditor reputation at p^*. Equation (1) at p^* reduces to:

$$\begin{aligned}\Pi(p^*,A) = bR(A) \\ +R'[f-g(a-\ell nA)] \\ -cA, \qquad (5)\end{aligned}$$

as follows from equation (4) and the fact that $E(v-\mu)^2=\sigma_v^2$. In order for a reputational equilibrium to exist that prevents agents from "selling out" and drawing their reputation capital to its lowest possible value, it must be that $\partial\Pi/\partial R' > 0$. To guarantee this condition we assume that $f-g(a-\ell nA)>0$

for all A, i.e., reputation is a desirable characteristic (for a discussion of the incentives to maintain reputation see Klein and Leffler [1981]).

The net benefits of auditor selection, including the gains to signaling, are:

$$\partial\Pi(p^*,A)/\partial A = b\bullet dR(A)/dA + g\bullet R'/A - c = 0, \quad (6)$$

which implies:

$$dR(A)/dA + [g/(bA)]R' = c/b. \quad (7)$$

Keeping in mind that the uninformed investors solve the same equation in which R' is replaced by the unknown $R(A)$, this equation can be solved as a first-order linear differential equation with variable coefficients [Hildebrand, 1976] producing:

$$R(A) = [c/(b+g)]A + k[A]^{-(g/b)}, \quad (8)$$

where k is the constant of integration which under the previous assumptions will be equal to zero (since $A \rightarrow 0$ when $\mathbf{R} \rightarrow 0$).

Before developing the testable implications of this model we first examine the equilibrium conditions of the model for consistency. Note that $dR(A)/dA$ equals $c/(b+g)$ from equation (8), thus equation (7) yields:

$$A^* = [(b+g)/c]R'. \quad (9)$$

By combining equations (9) and (8) for $k=0$, the equilibrium condition that $R' = R(A)$ is verified, i.e., actual reputation equals perceived reputation.[6] Investors still have an incentive to become informed, even though expected market value and investment banker reputation are perfectly signaled, because the informed investors know actual market value. Also, since $\partial^2\Pi/\partial A\,\partial\mu = 0$, auditor reputation cannot signal the expected value of the issue, i.e., $\partial\mu/\partial A = 0$ which is consistent with our earlier observation that μ is perfectly revealed by p^* once the auditor is selected.

From Theory to Measurement

In this subsection we make the transition from the theoretical determinants of underpricing to an equation for underpricing that can be empirically tested. In the process, four testable implications will be derived. The first two propositions are not unique and their predictions have been documented in previous studies. However, they provide a measure of consistency for the theoretical model. The final two propositions delineate the relation between underpricing and auditor reputation, revealing that the relation is not a simple one, yet is empirically verifiable.

Define UP as the relative level of underpricing given by $(v-p^*)/p^*$. From equation (4) for p^* we then find that $UP = (u/p^*) + \epsilon$ where $\epsilon = (v-\mu)/p^*$ and $E(\epsilon) = (1/p^*)E(v-\mu) = 0$. The following equations summarize the model for empirical purposes. First, from equations (8) and (9):

$$R(A) = R' = [c/(b+g)]A. \quad (10)$$

Second, from the definition for UP, since $u/p^* = h(\sigma_v^2 + \sigma_m^2)$, and using equation (10):

$$UP = h[a(\bullet) + r(\bullet)] - h\bullet \ell n[(b+g)/c]R' - h\bullet \ell n R' + \epsilon. \quad (11)$$

The terms $a(\bullet)$ and $r(\bullet)$, the exogenous part of *ex ante* firm-related and market-related uncertainty, respectively, are not directly observable (the empirical proxies

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[6] Second-order conditions for a maximum hold since at the optimum:

$$\partial^2\Pi/\partial p^2 = -2gR'[1 + h(\sigma_v^2 + \sigma_m^2)] < 0, \text{ and}$$
$$\partial^2\Pi/\partial A^2 = -R'/A^2 < 0.$$

Furthermore,

$$\partial^2\Pi/\partial p\partial A = \partial^2\Pi/\partial A\partial p = 0.$$

used will be discussed in Section III). Similarly, no exact measures for A and R' are available to us, in part because we are not informed investors. Instead we use observable A'' and R'' as our measures with:

$$A''=A+\epsilon_A=[(b+g)/c]R'+\epsilon_A \quad (12.A)$$

$$R''=R'+\epsilon_R, \quad (12.B)$$

where ϵ_A and ϵ_R have a mean of zero and variance of $\sigma^2_{\epsilon(A)}$ and $\sigma^2_{\epsilon(R)}$, respectively.

To the empirical observer two signals, equations (12.A) and (12.B), are available that predict R'. Using the least squares criterion it can be determined that:

$$E(R'\,|A'',R'')=[\lambda c/(b+g)]A''+(1-\lambda)R''$$

where

$$\lambda=\sigma^2_{\epsilon(R)}/\{\sigma^2_{\epsilon(R)}+[c/(b+g)]^2\sigma^2_{\epsilon(A)}\}.$$

Hence,

$$R'=[\lambda c/(b+g)]A''+(1-\lambda)R''+\eta \quad (13)$$

with $\eta=-[\lambda c/(b+g)]\epsilon_A-(1-\lambda)\epsilon_R$ and, thus, has an expected value of zero.

The following testable implications are derived from the above equations.

Proposition 1: Investment bankers with higher reputation tend to be associated with higher reputation auditors.

PROOF:

From equations (12.A) and (12.B) we have:

$$A''=[(b+g)/c]R''+\{\epsilon_A-[(b+g)/c]\epsilon_R\}. \quad (14)$$

A'' and R'' must be positively correlated. Intuitively, investment bankers with higher reputation have more to lose from mispricing, hence they have a higher marginal benefit of hiring a high reputation auditor. In the theoretical signaling context this implies a perfect correlation between investment banker and auditor reputation as represented by equation (10). Due to randomness introduced by the imperfect measure of reputation, the correlation between the measure for auditor reputation, A'', and the measure for investment banker reputation, R'', would be imperfect but positive.

Proposition 2: Investment bankers with higher reputations underprice less.

PROOF:

From equations (11) and (13)—which together form the empirically relevant equation for underpricing—we find:

$$\partial UP/\partial R''=(1-\lambda)(\partial UP/\partial R') = -2h(1-\lambda)/R'<0. \quad (15)$$

This result arises because a higher reputation investment banker chooses a higher reputation auditor in accordance with proposition 1. The higher reputation auditor reduces uncertainty concerning earnings and sends a positive signal of investment banker reputation to uninformed investors. For both these reasons, *ex ante* uncertainty is reduced so that less underpricing is required.

Proposition 3: The observed measure of auditor reputation helps reduce underpricing.

PROOF:

From equation (11), with use of equation (13),

$$\partial UP/\partial A''=[\lambda c/(b+g)]\,\partial UP/\partial R' = -[2h\lambda c/(b+g)]/R'<0. \quad (16)$$

Auditor reputation is an important signal in the informational environment of the new issue. A higher reputation auditor not only lowers the variance of the earnings estimate but, also, indicates an investment banker who has a lot to lose by misjudging earnings (and consequently mispricing the new issue). To the empirical observer, A'' helps to predict R' (or A, being perfectly correlated with R') and should, therefore, be related to lower levels of underpricing.

Proposition 4: As both investment banker and auditor reputation increase, their impact on underpricing is reduced.

PROOF:

From equation (16):

$$\begin{aligned}\partial^2 UP/\partial A''\partial R'' &= \partial^2 UP/\partial R''\partial A''\\ &= [2h\lambda(1-\lambda)c\\ &\quad /(b+g)]R'^{-2}>0. \quad (17)\end{aligned}$$

As implied by equation (17), for a higher reputation investment banker the effect of a higher reputation auditor on underpricing is positive (i.e., the collective effect is less negative). Similarly, the tendency for high reputation investment bankers to underprice is less when a high reputation auditor is employed. These results are due, basically, to the diminishing returns on information acquisition. Proposition 4 is essentially a qualification on the relations implied by propositions 2 and 3. Empirically, proposition 4 highlights that there is an interactive effect between investment banker and auditor reputation, with the collective impact being lower when both variables are relatively high.[7] In Section III we describe the sample and variables that are used to test these propositions.

III. THE SAMPLE AND VARIABLES

The sample is from the five-year period of 1981–1985. Only initial public equity offerings in the over-the-counter market with a price greater than or equal to one dollar and contracted as a firm offering were included in the sample.[8] Data on the offering price, number of shares, auditor, and investment banker were taken from *Going Public: The IPO Reporter*. The first market bid was obtained from the *OTC Daily Stock Price Record*. The first bid must be reported in the first five trading days for the issue to be included in the sample. These selection criteria provided a sample of 1,182 securities with complete data.

From equation (11) and the subsequent discussion, propositions 2, 3, and 4 are tested using the model:

$$\begin{aligned}UP_i = \alpha_0 &+ \alpha_1 BETA_i + \alpha_2 RSKPRE_i\\ &+ \alpha_3 IPOIDX_i + \alpha_4 \Delta_{IB(i)}\\ &+ \alpha_5 \Delta_{A(i)} + \alpha_6 \Delta_{IB*A(i)} + \epsilon_i. \quad (18)\end{aligned}$$

The dependent variable, UP_i, is the level of underpricing given by the proportional change in price from the issue to the first bid, i.e., $(v-p)/p$. The term $a(\bullet)$ in equation (11) representing uncertainty associated with the firm, is measured by the variable labeled *BETA* or systematic risk in equation (18). Estimation of the traditional market model *BETA* requires a trading history. Such a history doesn't exist for the sample. We use securities on the CRSP NASDAQ file to generate industry betas at the three-digit SIC level for each of the five sample years. Then for an observation whose issue date is, for example, in 1981, we assign that observation a value of *BETA* based on the market model beta

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[7] Formally, a second-order Taylor expansion around A and R of equation (11) using equation (13), yields as one of its terms

$$\begin{aligned}&[\partial^2 UP/\partial A''\partial R'']\\ &\quad (A''-A_0)(R''-R_0) = [2h\lambda(1-\lambda)c\\ &\qquad /(b+g)](A''-A_0)(R''-R_0)\\ &\qquad /R'^2,\end{aligned}$$

where (A_0, R_0) indicates the pair of particular values for A and R around which the approximation is taken. Essentially the use of an indicator variable for A'' and R'' results in an interaction term between the two variables.

[8] We specifically exclude NYSE and AMEX securities since they account for a very small number of issues (less than 50 during the entire sample period) and, more importantly, in a signaling environment there is a confounding effect of exchange certification that is not considered in the context of our model.

for the portfolio of all securities with the same three-digit SIC, measured using daily observations from 1980 (where the portfolio returns are regressed against the CRSP equal-weighted NASDAQ index).[9]

The variables *RSKPRE* (risk premium) and *IPOIDX* (initial public offering index) are used to measure market uncertainty as indicated in the term $r(\bullet)$ from equation (11). *RSKPRE* is a measure of the market risk premium based on the spread between the returns from a portfolio of corporate bonds and Treasury Bond returns. Bond returns are taken from the CRSP Indices file. Each observation is assigned a value for *RSKPRE* based on the bond return differential in the month the issue went public. The variable *IPOIDX* is a market index generated by creating a daily return index that, for a specific day, only includes securities that have been listed on the CRSP NASDAQ file for less than the prior 20 days. Thus, we have a pseudo market index that captures returns specifically for less seasoned securities. The daily index is then aggregated into a monthly index, and each observation is assigned a value of *IPOIDX* based on the month of the offering. In addition to measuring market uncertainty this variable also serves to capture other market effects such as the "hot issue" phenomenon [Ritter, 1984b].

To measure investment banker and auditor reputation we use dichotomies frequently used in previous studies. Auditor reputation is measured with an indicator variable set equal to one for Big Eight firms and zero otherwise (Δ_A). The classification scheme for investment banker reputation is similar to that of Downes and Heinkel [1982] and Neuberger and La Chapelle [1983]. Investment banking firms that, during the sample period, consistently appeared in the "Top 25" reported annually by *Institutional Investor* are included in the top reputation category. These firms also appear as "bulge" and "major" firms in Hayes [1971]. The indicator variable for investment banker prestige is assigned a value of one if the investment banker is in this top category and zero otherwise (Δ_{IB}). The 18 investment bankers that were consistently in this "Top 25" group during the five-year sample period and, thus, classified as prestigious are listed in the Appendix.[10]

From the theoretical results, the alternative hypotheses for the coefficients in equation (18) are $\alpha_1>0$, $\alpha_2>0$, and $\alpha_3>0$ (i.e., underpricing is a positive function of firm and market uncertainty), $\alpha_4<0$, $\alpha_5<0$ (i.e., high reputation investment bankers and high reputation auditors are associated with lower underpricing), and $\alpha_6>0$. The alternative for α_6 is from proposition 4: the joint impact of having both a high reputation underwriter and auditor is less negative.

IV. RESULTS

Descriptive Statistics

The sample of 1,182 initial public offerings represents 181 different investment banking firms. A cross-tabulation of the investment banker and auditor reputation classifications is presented in

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[9] For approximately ten percent of the securities, no SIC code match was available at the three-digit level. In this case we used a two-digit match, where the beta was the average of all three-digit level betas in that two-digit group.

[10] An obvious concern in using these binary classification schemes is whether the ninth largest auditor is much different from the eighth and whether the 19th largest investment banker is much different from the 18th. We consider the sensitivity of our results to this classification scheme in a subsequent section by excluding a "middle tier" of both auditors and investment bankers.

TABLE 1

INVESTMENT BANKER AND AUDITOR CLASSIFICATIONS[a]

Investment Banker	*Auditor* *Non-Big Eight*	 *Big Eight*	
Non-Prestigious	199 (16.8%)[b]	484 (41.0%)	683 (57.8%)
Prestigious	53 (4.5%)	446 (37.7%)	499 (42.2%)
	252 (21.3%)	930 (78.7%)	1,182

[a] This table provides a cross-tabulation of the binary variables used to classify auditor and investment banker reputation. The sample of 1,182 initial public offerings is from 1981–1985. Investment bankers classified as "prestigious" are reported in the Appendix.

[b] Tabular percentages do not sum consistently due to rounding error.

Table 1. Although the allocation of new issues to the different classifications of investment banker is roughly equal, clearly the Big Eight firms dominate the market for auditors, with more than 78 percent of the issues. When broken down by year, this allocational pattern did not exhibit any trends and appeared relatively stable.

Table 2 reports the mean and standard deviation for the sample variables by reputation categories and year. The average underpricing, 7.84 percent, is well within the range reported in previous studies (see Miller and Reilly [1987]). Since this study excludes best efforts offerings (typically smaller issuers), the average is lower than studies including such issues. The price-related variables reported for the four distinct reputation combinations suggest distinctive differences between the classifications; however, many of the univariate comparisons between groups are not statistically significant. Not surprisingly, underpricing was notably lower in 1984 when the "new-listing" market index was significantly negative.

Correlations for the sample variables are reported in Table 3. The direction of correlations between underpricing and the other continuous variables in the model is in all cases consistent with the theoretical model. The sign of the interaction is negative for the bivariate context. As expected from the tabular results in Table 1, the correlation between the interaction term and the investment banker measure is relatively high.

Table 4 examines the within and across group variation in more detail for the auditing firms. Peat, Marwick, Mitchell audited the greatest number of new issues in our sample (177). The average market capitalization of firms with Big Eight auditors was almost twice as large as non-Big Eight clients. The range of underpricing within the Big Eight was only 5.4 percent to 8.3 percent. If $v_i\{i=1,2,\ldots,8\}$ is the average underpricing for each Big Eight auditor, the null hypothesis that the v_i's are equal for

TABLE 2

DESCRIPTIVE STATISTICS FOR SAMPLE BY REPUTATION CATEGORIES AND YEAR[a]

	N	*Offer Price* (p)	UP	BETA	RSKPRE	IPOIDX
By Classification[b]						
$\Delta_{IB}=0$, $\Delta_A=0$	199	\$6.75 (0.29)[c]	13.06% (1.71)	1.24 (0.03)	−0.03% (0.07)	0.82% (0.51)
$\Delta_{IB}=0$, $\Delta_A=1$	484	8.55 (0.18)	8.79 (0.80)	1.21 (0.02)	−0.09 (0.05)	1.09 (0.33)
$\Delta_{IB}=1$, $\Delta_A=0$	53	13.10 (0.51)	2.96 (0.98)	1.20 (0.08)	0.09 (0.16)	0.27 (0.81)
$\Delta_{IB}=1$, $\Delta_A=1$	446	13.67 (0.22)	5.06 (0.56)	1.15 (0.02)	0.01 (0.05)	1.45 (0.35)
By Year						
1981	231	10.14 (0.37)	7.97 (1.11)	1.37 (0.04)	−0.33 (0.10)	−1.16 (0.47)
1982	87	10.42 (0.55)	10.02 (1.85)	1.22 (0.04)	−0.18 (0.15)	5.88 (1.08)
1983	513	11.55 (0.23)	9.51 (0.84)	1.15 (0.02)	0.10 (0.04)	2.02 (0.31)
1984	175	8.21 (0.25)	2.27 (0.88)	1.10 (0.04)	0.02 (0.06)	−2.91 (0.39)
1985	176	9.45 (0.34)	7.27 (1.12)	1.14 (0.03)	−0.04 (0.05)	3.32 (0.35)
All	1,182	10.38 (0.15)	7.84 (0.49)	1.19 (0.01)	−0.04 (0.03)	1.15 (0.21)

[a] *UP*=(first bid-offer price)/offer price; *BETA* is the market model beta assigned to the new issue based on the beta of a portfolio of firms with the same three-digit SIC from the previous year; *RSKPRE* (risk premium) is the return on corporate bonds minus the return on Treasury Bonds during the month of the new issue; and *IPOIDX* (initial public offering index) is the return on a market index during the month of the new issue, where the market index consists of all securities on the CRSP NASDAQ files that have been listed less than 20 days.

[b] Δ_{IB} is equal to one for prestigious underwriters and zero otherwise. Δ_A is equal to one for Big Eight auditors and zero otherwise.

[c] Standard errors are in parentheses.

all i cannot be rejected (F-statistic $=0.34$). The average level of underpricing for all Big Eight firms was seven percent, versus approximately 11 percent for non-Big Eight firms. This univariate comparison indicates a significant difference at a p-level of less than 0.001.

Empirical Tests of the Theoretical Implications

In this section each of the four propositions evolving from the theoretical model are empirically tested. The results in each case support the hypotheses generated from the theory.

TABLE 3
CORRELATIONS FOR THE MODEL VARIABLES[a]

	BETA	RSKPRE	IPOIDX	Δ_{IB}	Δ_A	Δ_{IB*A}
UP	0.056	0.042	0.232	−0.152	−0.095	−0.128
BETA		−0.034	0.025	−0.064	−0.043	−0.067
RSKPRE			−0.243	0.042	−0.016	0.031
Δ_{IB}					0.223	0.911
Δ_A						0.405

[a] Correlations are Pearson product-moment correlations. Variables are defined in Table 2 ($N=1,182$).

Proposition 1 posits that higher reputation investment bankers will be associated with higher reputation auditors. Table 1 shows that for non-prestigious investment bankers, 70.86 percent of the issues are audited by Big Eight firms. For prestigious investment bankers the proportion is 89.38 percent. Using a simple test of proportions, the null hypothesis that the proportion of Big Eight firms employed by prestigious versus non-prestigious investment bankers is equal can be rejected at a *p*-level of less than 0.0001. For the top five investment bankers (defined in the Appendix), the proportion of issues using a Big Eight auditor is an even higher 92.62 percent (113 of 122). With the exception of Merrill Lynch, none of the top five investment bankers used a non-Big Eight auditor more than once. These results provide strong empirical support for the tendency of high reputation investment bankers to select high reputation auditors.

Proposition 2 asserts that investment bankers with higher reputations will underprice less. As already noted, this particular conclusion does not distinguish this theory from others with similar conclusions, and has been previously documented. Evidence of this phenomenon is provided in Neuberger and La Chapelle [1983], who divide investment bankers into tiers and find significant differences in initial returns between investment bankers with different levels of prestige. A test of this proposition using the current sample is provided by the coefficient associated with Δ_{IB} in Table 5 which reports the estimate of equation (18). After adjusting for other effects, the use of a prestigious investment banker reduces underpricing by roughly ten percent and the effect is significant at a *p*-level of less than 0.001. Thus, consistent with previous studies, the current sample empirically supports the proposition that higher reputation investment bankers underprice less.

Proposition 3 indicates that a higher auditor reputation should reduce underpricing. The coefficient associated with Δ_A in the estimate of equation (18) provides a test of this assertion. Consistent with proposition 3, auditor reputation has a signifcantly negative effect, reducing the level of underpricing by approximately 4.2 percent.

The indicator variable $\Delta_{IB\cdot A}$ is equal to one only for the case where investment banker and auditor reputation are both high. Proposition 4 states that the negative effects of investment banker and auditor reputation on underpricing will be reduced (i.e., become less negative) if both variables are high. This implies that the coefficient associated with $\Delta_{IB\cdot A}$

TABLE 4
A COMPARISON OF UNDERPRICING AND OFFER SIZE BY AUDITOR[a]

Auditor	N	Underpricing	Offer Size (000's)
Big Eight			
1. Arthur Andersen	145	7.21% (1.24)	$16,805. (1,667.)
2. Coopers & Lybrand	87	8.25 (1.87)	13,606. (1,570.)
3. Deloitte, Haskins & Sells	86	7.56 (1.66)	17,029. (2,805.)
4. Ernst & Whinney	110	7.87 (1.57)	14,600. (1,340.)
5. Peat, Marwick, Mitchell	177	6.68 (1.13)	17,969. (2,547.)
6. Price Waterhouse	102	5.44 (1.17)	18,080. (2,143.)
7. Touche Ross	109	6.85 (1.21)	13,358. (1,485.)
8. Arthur Young	114	6.54 (1.63)	19,389. (2,036.)
All Big Eight	930	7.00 (0.50)	16,540. (752.)
Non-Big Eight	252	10.94 (1.39)	8709. (757.)

[a] Standard errors are reported in parentheses.

should be positive. Consistent with this proposition, α_3 is positive and significant at a p-level of 0.014. The offsetting effect of the interaction term is nontrivial and could explain why previous studies have had difficulties in identifying a relation between auditor selection and underpricing (e.g., Beatty [1986]).

The use of indicator variables for both reputation measures is clearly a coarse approximation. To determine the robustness of our results to this classification scheme we reestimated equation (18) using two alternative classification schemes. In the first test, we excluded from the sample the following "middle tier" groups. For auditors we excluded the seven middle tier firms identified in Simunic and Stein [1987, p. 66]. For investment bankers we excluded all firms listed in Hayes' "Major" and "Submajor" brackets that were not included in the top-18 classification used. This reduced the sample by 274 observations. As a second alternative, we replace the Big Eight binary variable with the values of auditor fees reported in Beatty [1986] (providing an interaction term where the fee is multiplied times the investment banker dummy variable), thus, using the auditor fee as a surrogate for reputation. The results from the regressions, in both

TABLE 5

TESTS OF PROPOSITIONS 2, 3, AND 4[a]
(BASED ON ESTIMATE OF EQUATION (18))

UP	$=$	α_0	$+$	$\alpha_1 BETA$	$+$	$\alpha_2 RSKPRE$	$+$	$\alpha_3 IPOIDX$	$+$	$\alpha_4\Delta_{IB}$	$+$	$\alpha_5\Delta_A$	$+$	$\alpha_6\Delta_{IB*A}$	R^2[b]
		0.107 (0.017)[c]		0.015 (0.010)		1.823 (0.465)		0.612 (0.067)		−0.099 (0.025)		−0.043 (0.013)		0.058 (0.027)	0.090

[a] Parameter estimates for the empirical model of equation (18) applied to the 1981–1985 sample of 1,182 initial public offerings.

[b] R^2 is adjusted for degrees of freedom.

[c] Standard errors are reported in parentheses.

cases, were identical to those reported in Table 5 with respect to the sign and significance of the variables. That is, all variables were significant at the 0.05 level except *BETA*, which was significant at the 0.10 level.

V. CONCLUSIONS

A theoretical model that explicitly incorporates the relation between investment banker and auditor is developed to provide a more rigorous framework for testing the effect of auditor selection in the issuance process. The model can be seen as a subset of more general theories modeling the new issue market. The theoretical model generates a number of testable propositions. Two of the propositions, that high reputation investment bankers more frequently use high reputation auditors and that they underprice less, are results that have been previously documented. The sample in this study confirms these results.

The theory suggests that both investment banker and auditor reputation have a negative effect on underpricing. More interestingly, as either one of these variables increases, the impact of the other variable diminishes. The empirical results confirm this more complex relation.

There is a diversity of research attempting to explain the intricate informational environment present in an initial public offering. The complexity of signaling models makes it difficult to resolve these issues in a singular exhaustive theory. Using a simple theory based on an investment banker's profit function, we attempt to model the effects associated with auditor selection. The reputation of the auditor in this model serves to provide two important effects on the information environment—a straightforward reduction of uncertainty associated with earnings and, more subtly, a signal to the marketplace about the reputation of the underwriting coalition. The implications of our theoretical model are consistent with the sample tested in this study. The structure of the model could explain the difficulties of previous studies in identifying an empirical relation between auditor reputation and underpricing.

Appendix

Prestigious Investment Bankers

Investment bankers included in the prestigious category, ($\Delta_{IB}=1$), are:

1. Salomon Brothers*
2. First Boston*
3. Merrill Lynch*[a]
4. Goldman Sachs*
5. Morgan Stanley*
6. Drexel Burnham Lambert
7. Shearson Lehman Brothers
8. Kidder, Peabody
9. Paine Webber
10. Smith Barney, Harris Upham
11. Prudential-Bache Securities
12. E. F. Hutton
13. Bear Stearns
14. Dean Witter Reynolds
15. Dillon Read
16. Lazard Freres
17. Rothschild, Unterberg, Towbin
18. Donaldson, Lufkin & Jenrette

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* Indicates that the investment banker is included in the "bulge" group as defined in Hayes [1971].

[a] Becker Paribus was consistently ranked in the "Top 25" until 1984 when it was acquired by Merrill Lynch and is thus classified as "prestigious" for the 1981-1984 period.

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Sequential Belief Revision in Auditing

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ABSTRACT: Five experiments that examined sequential belief revision in simplified auditing contexts are reported. The results suggest that auditors' belief revisions depend on both the order in which evidence is received and the manner in which it is presented, and they provide preliminary insights into auditors' "attitudes" toward evidence. The results also suggest that audit judgment may differ from judgment in general in two ways. First, the subjects were "prone" to revise their beliefs when new evidence was received, while the behavioral decision theory literature suggests that persons in general tend to "avoid" new evidence. Second, the subjects revised their beliefs to a greater extent when they received evidence that tended to disconfirm their current beliefs, whereas the literature suggests that persons in general are more strongly influenced by confirming evidence.

THIS paper reports the initial tests of a new descriptive model of belief revision that may have important implications for auditing research and practice. The model—proposed recently by Einhorn and Hogarth [1985]—has three features which make it particularly useful in audit settings: (1) it posits a sequential belief revision process, which is consistent with existing characterizations of audit judgment by auditing researchers and practitioners; (2) it predicts that belief revision is influenced by both the order in which evidence is received and the manner in which it is presented, which may have implications for the conduct of an audit; and (3) it offers insights into auditors' "attitudes" toward evidence and the effects of such attitudes on belief revision, which may have implications for audit training and for understanding the nature of audit expertise. Thus, the insights provided by applying the model to sequential belief revisions by auditors may have implications for audit efficiency and effectiveness.

The sequential nature of audit judgment is emphasized by both researchers and practitioners. For example, Kinney's [1975] normative treatment of decisions involving control system reliance, audit testing, and choice of opinion relies on the sequential nature of those activities, as does the Tomassini et al. [1982] de-

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scriptive treatment of auditors' probability assessments. Moreover, Cushing and Loebbecke's [1986] analysis of written materials supplied by large auditing firms as well as generally accepted auditing standards, has led to a largely sequential model of the audit process. Similarly, the research of Gibbins [1984], based in part on interviews with practitioners, describes "routine" audit judgment as a continuous, incremental process which is conditional on information that arrives sequentially and which results in a cycle of choices, actions, and feedback that promotes learning. In addition, recent descriptions by practitioners of the audit technologies used by their firms make clear the sequential nature of the audit process and audit judgment (e.g., Elliott [1983] and Grobstein and Craig [1984]).

Perhaps it is not surprising that audit practitioners and researchers rely on sequential notions of judgment. Several behavioral decision theorists have observed that much of judgment *in general* may be characterized by sequential processes (e.g., Anderson [1981], Einhorn and Hogarth [1985], Hogarth [1981], Newell and Simon [1972], and Payne [1982]). Thus, models that allow sequential processing to be represented may incorporate important determinants of audit judgment, including belief revision, that otherwise might be neglected.

The dominant *normative* model of belief revision is Bayes' theorem, which for the past two decades has played a central role in studies of audit evidence evaluation, as well as in other areas of accounting research. The appeal of Bayes' theorem is strong because it is a logical consequence of conditional probabilities and because it can be embedded easily in a general theory of rational choice.

However, research in behavioral decision theory has established that the Bayesian formulation is incomplete as a *descriptive* model of belief revision. Much of the early research attributed the systematic discrepancies that occurred between Bayesian and intuitive revisions to a tendency for individuals to fail to extract all available information from samples of data, a phenomenon labeled "conservatism." Other research, however, suggested that intuitive revisions are nonoptimal in a more fundamental sense than is implied by the notion of conservatism. For example, Pitz, Downing, and Reinhold [1967], in a study of sequential probability revision, concluded that intuitive revisions are determined "in large part by task characteristics which are irrelevant to the normative model" (p. 392). Later research established that two such task characteristics are the order in which new information is received and the manner in which it is presented. Both of these characteristics relate directly to the sequential nature of audit tasks.

The remainder of the paper is organized in four sections. First, we summarize the model of sequential belief revision proposed by Einhorn and Hogarth [1985], describe the applicability of the model to auditing, and explain its predictions that were tested by our experiments. The next two sections provide an overview of procedures and subjects, and present the designs and results of five experiments that addressed the model's predictions. Finally, we elaborate on the results and discuss some avenues for further research.

THE CONTRAST/SURPRISE MODEL

The Einhorn and Hogarth [1985] model posits a simple, plausible psychological mechanism which involves an anchoring-and-adjustment strategy and which relies on the notion that people are sequential information processors with limited capacity.[1] An individual's current belief is assumed to provide an anchor that is adjusted on the basis of new evidence. The revised belief then becomes the anchor for the next adjustment, and the process continues sequentially. The model's appeal is strengthened by the fact that it requires little working memory or computational ability.

The Einhorn and Hogarth model incorporates three characteristics of additional evidence that also play a role in Bayes' theorem—(1) direction, (2) strength, and (3) type. More importantly, however, it considers two other important features of evidence that Bayes' theorem ignores—order and presentation mode. Finally, it includes a parameter that represents an individual's "attitude toward evidence."

Direction, Strength, and Type of Evidence

First, consider the direction, strength, and type of evidence. *Direction* of evidence refers to whether the evidence supports or does not support a current belief. Additional evidence that supports a belief is positive (or confirming) evidence, while additional evidence that does not support a belief is negative (or disconfirming) evidence. A second characteristic of additional evidence is its *strength*, or the degree to which it confirms or disconfirms a current belief (weakly or strongly). Finally, evidence *type* can be consistent or mixed. When all the additional evidence is of the same direction (either positive or negative), it is consistent. In contrast, when some evidence is positive and some negative, the evidence is mixed.

To illustrate in an auditing setting, suppose an auditor initially believes—based on a review of controls and the results of limited analytical procedures—that the net balance of accounts receivable is likely to be fairly stated in accordance with generally accepted accounting principles. Additional audit evidence about receivables can be either positive or negative; that is, it can either increase or decrease the degree of the auditor's initial belief about fair presentation. Moreover, each piece of additional evidence collected is not likely to be equally persuasive to the auditor; instead, its strength with respect to confirming or disconfirming the initial belief about fair presentation is likely to vary depending on its source or other factors. Finally, note that *all* of the additional evidence collected could confirm, or disconfirm, the initial belief; alternatively, the additional evidence could be mixed in its apparent implications about fair presentation.

Order and Presentation Mode

As indicated earlier, the direction, strength, and type of evidence are relevant to the Bayesian model as well as to the contrast/surprise model. However, these three evidence characteristics can be combined to consider the *order* in which additional evidence is presented. Evidence order can be extremely important in sequential processing and in *models* of sequential processing. Note that in sequential processing weak evidence can follow strong evidence (or vice versa), negative evidence can follow positive evidence (or vice versa), and so on. A crucial question addressed by the Einhorn and Hogarth model is the conditions under which evidence order will affect belief revision.

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[1] The anchoring-and-adjustment mechanism which underlies the Einhorn and Hogarth model should not be confused with the anchoring-and-adjustment *heuristic* discussed by Tversky and Kahneman [1974]. While the popular view of this heuristic emphasizes the "biases" to which its use can lead, e.g., reliance on irrelevant anchors and insufficient adjustment from an anchor, Einhorn and Hogarth treat anchoring and adjustment simply as a general belief-updating strategy which leads to systematic and predictable responses (see, also, Hogarth [1981] and Lopes and Ekberg [1980]).

As an auditing illustration, consider the receivables setting mentioned earlier. Most auditors probabily would agree that beliefs about fair presentation should be influenced by the direction, strength, and type of evidence, but not by the *order* in which it is collected. If the auditor's degree of belief about fair presentation depends on whether strong evidence is received before or after weak evidence, or on whether positive evidence is received before or after negative evidence, then the amount of additional evidence collected, and potentially the efficiency and effectiveness of the audit, can vary.

While order effects can be important in sequential evidence presentations, in some situations evidence can be presented "simultaneously," or all at once, and one's belief revised only once in response to all of the evidence. The Einhorn and Hogarth model specifies the conditions under which sequential presentation of consistent evidence will result in greater or lesser belief revision than will simultaneous presentation. More specifically, the model predicts smaller revisions for sequential presentation for individuals who are evidence-avoiding, but smaller revisions for simultaneous presentation for individuals who are evidence-prone. Briefly, evidence avoidance implies a reduction in the perceived, or subjective, strength of evidence, while evidence proneness implies that the evidence gains in subjective strength—because of one's general "attitude" toward evidence. The notion of evidence attitudes is explained more fully in the following two subsections of the paper. The experiments reported here tested the predicted order and presentation mode effects, and the results provide preliminary evidence about auditors' attitudes toward evidence.

The Model's Combination Rules

A key feature of the Einhorn and Hogarth model is that separate combination rules are used to incorporate negative evidence (which disconfirms a prior belief) and positive evidence (which confirms a prior belief). Einhorn and Hogarth develop a "discounting" model for negative evidence, and a parallel "accretion" model for positive evidence. Evidence is assumed to be correctly identified as either positive or negative before being combined with the current belief. Adjustment is then made according to the discounting or accretion process based on whether the evidence disconfirms or confirms the prior belief. The discounting and accretion models are combined to form the following "mixed evidence" model:

(discounting model, for negative evidence)

$$S_k = S_{k-1} - w_{k-1}s(a_k) \tag{1}$$

(accretion model, for positive evidence)

$$S_k = S_{k-1} + r_{k-1}s(b_k)$$

where

S_k = strength of belief after evaluating k pieces of evidence ($0 \leq S_k \leq 1$);
S_{k-1} = strength of belief after evaluating $k-1$ pieces of evidence, i.e., the current position or anchor before evaluating the kth piece of evidence ($0 \leq S_{k-1} \leq 1$);
a_k = strength of the kth piece of negative evidence ($0 \leq a_k \leq 1$);
b_k = strength of the kth piece of positive evidence ($0 \leq b_k \leq 1$);

$s(a_k)$ = subjective strength of the kth piece of negative evidence ($0 \leq s(a_k) \leq 1$);
$s(b_k)$ = subjective strength of the kth piece of positive evidence ($0 \leq s(b_k) \leq 1$);
w_{k-1} = adjustment weight for negative evidence; and
r_{k-1} = adjustment weight for positive evidence.

Equation (1) incorporates two important notions. First, evidence is evaluated regarding its strength, $s(a_k)$ or $s(b_k)$, and then used to adjust the current belief, S_{k-1}. Second, the adjustment weight, w_{k-1} or r_{k-1}, represents how the strength of the current belief affects the adjustment process. It is assumed that:

(for negative evidence)

$$w_{k-1} = S_{k-1} \tag{2}$$

(for positive evidence)

$$r_{k-1} = (1 - S_{k-1})$$

By making the adjustment weight for negative evidence equal to the anchor, and the adjustment weight for positive evidence inversely proportional to the anchor, this assumption incorporates a contrast or surprise effect. For example, a larger anchor (a strongly held belief) implies a *larger* adjustment weight for additional negative evidence, but a *smaller* adjustment weight for additional positive evidence. This means that negative evidence will affect a strongly held belief more than it will impact a weakly held belief. Stated differently, larger anchors are "hurt" more than smaller ones by the same negative evidence. Analogously, weakly held beliefs are increased more by *positive* evidence than are strongly held beliefs, i.e., the same positive evidence "helps" a smaller anchor more than it helps a larger one.

Einhorn and Hogarth specify:

(for negative evidence)

$$s(a_k) = a_k^{\alpha} \tag{3}$$

(for positive evidence)

$$s(b_k) = b_k^{\beta}$$

where $\alpha(\geq 0)$ represents an individual's attitude toward negative or disconfirming evidence and $\beta(\geq 0)$ represents one's attitude toward positive or confirming evidence. The α and β parameters can be interpreted as follows: $\alpha > 1$ implies a "disconfirmation avoiding" attitude, since negative evidence is discounted; $\alpha = 1$ implies a "disconfirmation neutral" attitude; and when $0 \leq \alpha < 1$ the evidence gains in subjective strength since the attitude is "disconfirmation prone." Similarly, $\beta > 1$ implies that positive evidence is reduced in strength, as the attitude is confirmation avoiding; $\beta = 1$ implies a confirmation neutral attitude; and $0 \leq \beta < 1$ implies that one's attitude is confirmation prone.

Substituting equations (2) and (3) into equation (1) yields the full mixed evidence model:

(discounting model, for negative evidence)

$$S_k = S_{k-1} - S_{k-1} a_k^{\alpha} \tag{4a}$$

(accretion model, for positive evidence)

$$S_k = S_{k-1} + (1 - S_{k-1}) b_k^{\beta}$$

or

$$S_k = S_{k-1}(1 - a_k^{\alpha}) \tag{4b}$$

$$S_k = S_{k-1}(1 - b_k^{\beta}) + b_k^{\beta}.$$

Thus, the model implies that the strength of belief after processing k pieces of evidence is a function of two factors: (1) the size of the $k-1$ anchors (and, thus, the size of the adjustment weights); and (2) the subjective strength of the evidence. The latter factor is due to two components: (a) the "objective" strength of the evidence and (b) one's attitude toward confirming and disconfirming evidence.

The attitude toward evidence component is a principal feature that distinguishes the contrast/surprise model from other non-Bayesian models of belief revision.[2] We show in the following subsection that this component is crucial in determining the impact that presentation mode is predicted to have on the extent of belief revision.

The Model's Predictions

Absence of order effects for consistent evidence. No order effects are predicted by the discounting model when a sequence of consistent negative evidence is processed. The same is true for the accretion model in the case of consistent positive evidence. To see why no order effects should occur, consider equation (4) when $k=2$ (substituting $s(a_k)$ for a_k^α and $s(b_k)$ for b_k^β). For negative evidence, using the discounting model from equation (4b),

$$S_2 = s_0[1-s(a_1)][1-s(a_2)], \qquad (5)$$

and for positive evidence, using the accretion model from equation (4a),

$$S_2 = s_0 + (1-s_0)[s(b_1)+s(b_2) - s(b_1)s(b_2)]. \qquad (6)$$

Since multiplication and addition are commutative, S_2 is not affected by the order of a_1 and a_2 or by the order of b_1 and b_2. Thus, the discounting and accretion models predict no order effects for the sequential processing of consistent evidence. Our Experiments 1A and 1B test this prediction.

Presence of order effects for mixed evidence. When the discounting and accretion models are combined, the resulting mixed evidence model predicts order effects in the sequential processing of mixed evidence. Order effects are predicted because the adjustment weight for the kth piece of evidence depends on the current anchor, which depends on the strength and sign of previously evaluated evidence. The contrast or surprise effect, which is determined by the adjustment weight, is greater for positive evidence when the anchor is small and for negative evidence when the anchor is large.

The prediction of order effects by the mixed evidence model can be demonstrated by considering the strength of belief after receiving positive evidence followed by negative evidence, $S(+-)$, versus receiving negative evidence followed by positive evidence, $S(-+)$. This is shown in Figure 1, given the initial belief, s_0. The slopes of the lines connecting $k=0$ and $k=1$ versus the slopes connecting $k=1$ and $k=2$ indicate that positive evidence has a greater accretion impact in the $(-+)$ sequence, and that negative evidence has a greater discounting impact in the $(+-)$ sequence. Thus, greater weight is given to evidence processed later in the sequence than to evidence processed earlier, that is, a recency effect.

This effect is caused by the new an-

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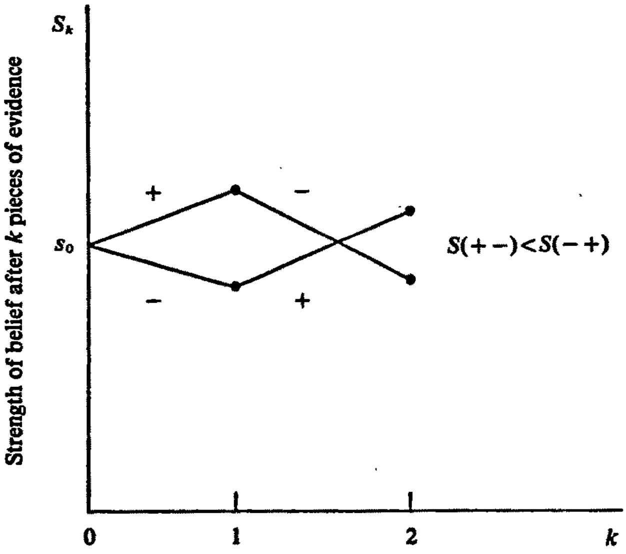
[2] As explained below, another feature that distinguishes the contrast/surprise model from other non-Bayesian models of belief revision is the *pattern* of order effects predicted for consistent and mixed evidence, i.e., no order effects for consistent evidence but recency effects for mixed evidence. As examples, an alternative model developed by Anderson [1981] predicts primacy effects (i.e., greater impact of evidence appearing *early* in a sequence) for both consistent and mixed evidence, and one developed by Lopes [1982] predicts recency effects (greater impact for evidence appearing *late* in a sequence) for both types of evidence (see, also, Lopes [1985; 1987]). Moreover, Einhorn and Hogarth [1985] develop three additional non-Bayesian models, none of which predicts the order-effects pattern of the contrast/surprise model.

FIGURE 1

HYPOTHETICAL "FISHTAIL" PATTERN SHOWING RECENCY EFFECTS FOR MIXED EVIDENCE



chors at $k=1$, the positions of which depend on the sign of the first evidence processed. The differences in slopes lead to lines that cross in a "fishtail" pattern. Recency is implied because the final position for the $(+-)$ order is lower than the final position for the $(-+)$ order. Einhorn and Hogarth's analytical results indicate that recency effects should be larger when both positive and negative evidence are strong, and that the initial position, s_0, should have no impact on the size of recency effects. Our Experiments 2A and 2B test the prediction of recency effects.

Presentation mode effects in sequential and simultaneous processing. We noted earlier that evidence can be presented sequentially, as assumed in our discussion of order effects, and one's belief revised after each piece of evidence is presented, or it can be presented "simultaneously," or all at once, and one's belief revised only once in response to all of the evidence. The model predicts that, under certain conditions, sequential presentation of consistent evidence will result in greater belief revision than will simultaneous presentation, while under other conditions the opposite will be true. The conditions have to do with one's attitude toward evidence.

For simultaneous processing, Einhorn and Hogarth assume that the evidence is evaluated as a whole and then integrated with the current belief. For example, the simultaneous evaluation of two pieces of negative evidence, denoted $s(a_1,a_2)$, is assumed to involve integration of the objective strength of the evidence by the accretion model, and the subsequent evaluation of its subjective strength. That is,

$$\begin{aligned} s(a_1,a_2) &= [a_1+(1-a_1)a_2]^{\alpha} \\ &= [a_1+a_2-a_1a_2]^{\alpha}. \end{aligned} \quad (7)$$

Einhorn and Hogarth show that the belief (S_2) that results from sequentially discounting a_1 and *then* a_2 is greater than the belief (S^*) that results from discounting $s(a_1,a_2)$ under the following condition:[3]

$$[a_1+a_2-a_1a_2]^\alpha > (a_1)^\alpha + (a_2)^\alpha - (a_1)^\alpha(a_2)^\alpha. \quad (8)$$

When $\alpha=1$, the two terms in equation (8) are equal. However, when $\alpha>1$, i.e., one's attitude toward negative evidence is disconfirmation avoiding, the inequality holds and $S_2>S^*$. This is called a "dilution" effect in the sequential processing of the evidence to indicate that sequential processing weakens the impact of the evidence. On the other hand, when $0\leq\alpha<1$, i.e., one's attitude toward negative evidence is disconfirmation prone, the inequality holds in the opposite direction and a dilution effect is predicted for simultaneous processing.

A similar inequality can be developed for consistent *positive* evidence. Analogous to equation (8), it predicts that a dilution effect will occur for sequential processing when one's attitude toward positive evidence is confirmation avoiding, i.e., when $\beta>1$, and that a dilution effect will occur for simultaneous processing when one's attitude is confirmation prone, i.e., when $0\leq\beta<1$. Our Experiment 3 concerns the predicted dilution effects.

Evidence Supporting the Model

Einhorn and Hogarth [1985] reported five experiments that tested the predictions of the contrast/surprise model with respect to order effects. The experiments had students judge the likelihood of a particular causal hypothesis in each of four general knowledge settings (involving advertising, baseball, lung cancer, and stereo speakers). Experiment 1 involved two pieces of consistent positive evidence (favoring the hypothesis), while Experiment 2 involved two pieces of consistent negative evidence (not favoring the hypothesis). The results supported the accretion and discounting models' prediction of no order effects for consistent positive and consistent negative evidence.

Experiments 3, 4, and 5 involved both positive and negative evidence, and their purpose was to test the mixed evidence model's prediction of recency effects. Experiment 3 involved two pieces of evidence (one positive, one negative), while Experiments 4 and 5 involved four pieces of evidence (two positive, two negative). As predicted, recency effects were found in all three experiments. Einhorn and Hogarth [1985] also reanalyzed the results of an earlier study reported by Shanteau [1970], and again found the recency effects predicted by the contrast/surprise model. In a later paper, Einhorn and Hogarth [1987] present the results of additional experiments that support the model's predictions.

OVERVIEW OF EXPERIMENTS

Four of our five experiments were similar in structure to those of Einhorn and Hogarth [1985]. Experiment 1A (1B) tested the prediction of no order effect for consistent positive (negative) evidence. Experiments 2A and 2B both tested the prediction of recency effects for mixed evidence. Unlike Einhorn and Hogarth [1985], however, all of these experiments involved four pieces of additional evidence.

Moreover, in addition to testing for order effects, each of our first four experiments tested the model's predictions about the size of the anchor (i.e., strength of initial belief) by manipulating

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[3] From equation (5), $S_2=s_0[1-s(a_1)-s(a_2)+s(a_1)s(a_2)]$, and from equations (1) and (2), $S^*=s_0-s_0s(a_1,a_2)$. Subtracting S^* from S_2 yields $S_2-S^*=s_0\{s(a_1,a_2)-[s(a_1)+s(a_2)-s(a_1)s(a_2)]\}$. Using equation (3) for $s(a_k)$ and equation (7) for $s(a_1,a_2)$ yields $S_2-S^*=s_0\{[a_1+a_2-a_1a_2]^\alpha-[a_1^\alpha+a_2^\alpha-a_1^\alpha a_2^\alpha]\}$, from which the inequality in equation (8) is derived.

TABLE 1
SUMMARY OF THE FIVE EXPERIMENTS

Experiment	*Design*[a]		Prediction	Prediction Supported?
	Variables	*Levels*		
1A	Order	SSWW(+), WWSS(+)	No order effect for consistent positive evidence	Yes
	Anchor	.20, .50, .80	Small anchors increased more by positive evidence than large anchors	Yes
1B	Order	SSWW(−), WWSS(−)	No order effect for consistent negative evidence	Yes
	Anchor	.20, .50, .80	Large anchors decreased more by negative evidence than small anchors	Yes
2A	Order	++−−, −−++	Recency effect for mixed evidence	Yes
	Anchor	.20, .50, .80	See 1A and 1B above	Yes
2B	Order	++−−, −−++	Recency effect for mixed evidence	Yes
	Anchor	.20, .50, .80	See 1A and 1B above	Yes
3	Direction of Evidence	++++, −−−−	Interaction between direction of evidence and presentation mode	Yes
	Presentation Mode	Sequential, Simultaneous		

[a] All experiments involved four pieces of additional evidence, denoted here as + (positive), − (negative), S (strong), and W (weak).

anchor size across three subject groups. Experiment 3 examined the "dilution" effect in an attempt to infer whether our subjects have evidence-prone, evidence-avoiding, or evidence-neutral attitudes. Einhorn and Hogarth [1985] reported no tests of either anchor or dilution effects.[4]

The subjects for the five experiments were 211 practicing auditors enrolled in a continuing professional education program in Calgary and Edmonton, Alberta.[5] Their mean experience level in public accounting practice was 2.9 years. The subjects completed three experiments in the same order (1A-2A-3 or 1B-2B-3), taking an average of approximately 20 minutes. Table 1 summarizes the five experiments.

The experiments reported here emphasize internal validity more than external validity. Thus, they might be considered more basic than most audit judgment research. We believe it is essential, in auditing contexts and elsewhere, for basic research to first support the validity of a judgment model in simplified, well-defined settings before addressing issues of more immediate concern to practitioners.

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[4] Einhorn and Hogarth [1987] present an alternative functional form of the contrast/surprise model (called the contrast-inertia model) which makes the same predictions with respect to order effects. However, the dilution effect investigated in the present paper is based on Einhorn and Hogarth [1985].

[5] A pilot group of 60 auditing students at the University of Alberta also participated in Experiments 1A, 2A, and 3. The results for Experiments 1A and 3 were virtually identical to those obtained from the auditors. The results from Experiment 2A were similar (i.e., a recency effect was found), but were not statistically significant.

TASKS, DESIGNS, AND RESULTS

Experiment 1A

The first experiment involved sequential processing of four pieces of consistent positive evidence, two of which were strongly positive and the other two weakly positive. The principal issue was the accretion model's prediction of no order effect for consistent positive evidence. In addition, the strength of the initial belief (anchor) was manipulated to test Einhorn and Hogarth's contention that smaller anchors are "helped" more by positive evidence than larger ones.

Design. Subjects were asked to assume that they were investigating the payroll records of an audit client and were told that a preliminary investigation of the internal controls over payroll had indicated that the likelihood the controls would prevent or detect material error was either .20, .50, or .80. These numbers served as anchors which were updated after each piece of positive evidence about the controls was presented.

The evidence read as follows:

> The tasks of timekeeping and payment of employees are adequately segregated from the task of payroll preparation.
>
> The tasks of payroll preparation and payment of employees are adequately segregated from the task of payroll bank account reconciliation.
>
> When new employees are hired, an inquiry is made as to their backgrounds and former employers.
>
> The internal controls over payroll were found to be satisfactory during the previous audit.

Each piece of evidence was followed by the statement, "You consider this a strength of the system."

The evidence was taken from an earlier "policy capturing" study in which the subjective strength of each item had been estimated (Ashton and Brown [1980]). By using Ashton and Brown's evidence, we had some indication of the subjective strengths of the evidence used in this experiment (and in Experiments 1B and 2A) as perceived by a different group of auditors. Based on their results, the first two pieces of evidence were considered strongly positive, while the latter two were considered weakly positive.

The evidence was presented in two orders: the two pieces of strong positive evidence followed by the two pieces of weak positive evidence (SSWW), and the two pieces of weak positive evidence followed by the two pieces of strong positive evidence (WWSS). The order within the strong evidence, and within the weak evidence, was the same in both presentation orders. After each item was presented (one per page), the subjects were asked, "Now, what do you believe is the likelihood that the system will prevent or detect material error?" Responses were made by marking an X on a line numbered from zero to 100. This response scale was numbered at five-point intervals with no other descriptive labels.

To encourage subjects to code the strong evidence as strong and the weak evidence as weak, as assumed by the model, they were told (for the strong evidence), "You feel it is important... to include in your examination some internal control factors that relate to segregation of duties. You know that proper segregation of duties is considered a crucial feature of internal control systems." At the completion of the experiment, the subjects provided information for a manipulation check by allocating 100 points to the four pieces of evidence (listed in a SWSW order) to indicate their perceptions of the relative importance of each in an internal control investigation.

Results. The results of the manipulation check indicate that the strong evidence was seen as strong and the weak evidence was seen as weak. The median numbers of points assigned to the two pieces of strong evidence were 40 and 30, while the median numbers assigned to the weak evidence were 10 and 20. The principal results, however, relate to the change in beliefs after the new evidence was presented. The dependent variable is the likelihood rating after the fourth piece of evidence (S_4) *minus* the initial position or anchor (s_0). Thus, positive numbers denote increases from the anchor.

The data were analyzed via a 2 (orders) × 3 (anchors) ANOVA with 16 subjects per cell.[6] The mean belief change for subjects receiving an anchor of .20 was .266, while the mean change for anchors of .50 and .80 was .207 and .043, respectively. The ANOVA results indicate that the effect due to size of anchor is highly significant ($F=28.29$; $p<.001$). Thus, Einhorn and Hogarth's contention that smaller anchors are "helped" more by positive evidence than larger ones is supported.[7]

Mean belief change in the SSWW order was .168, while that in the WWSS order was .176. The difference between the two orders is not significant ($F=0.08$; $p=.772$), which supports the accretion model's prediction of no order effect for consistent positive evidence. Moreover, the interaction between presentation order and strength of initial belief is not significant ($F=0.87$; $p=.422$), also as predicted by the model.

Experiment 1B

Experiment 1B was identical to Experiment 1A, except that the evidence presented was consistently negative instead of consistently positive. The principal issue was the discounting model's prediction of no order effect when a sequence of consistent negative evidence is processed. Again, the anchor was manipulated, in this case, to test the contention that larger anchors are "hurt" more than smaller ones by negative evidence.

Design. Experiment 1B was based on the payroll audit scenario used in Experiment 1A. The only change was in the wording of the four pieces of evidence: The word "not" was inserted in each statement (e.g., "The tasks of timekeeping and payment of employees are *not* adequately segregated from the task of payroll preparation") to indicate that the evidence was negative. Each piece of evidence was followed by the statement, "You consider this a weakness of the system." All other aspects of the experimental materials, including the manipulation check, were identical to those of Experiment 1A.

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[6] Responses were randomly eliminated from some cells in Experiment 1A (and in the other four experiments) to achieve equal cell sizes. The maximum number eliminated from any cell in any experiment was three, and the mean across all cells in all experiments was 1.46. However, the analyses were also run with unequal cell sizes, and the results did not change. A combination of systematic and random elimination of responses was used in Experiment 3 (see fn. 9).

[7] While we present results of the anchor manipulation with results of the order manipulation, we do not consider the two types of results equally important. In particular, observe that when one's anchor is sufficiently high (low) it is not *possible* to make a large upward (downward) adjustment. Thus, the effect of our anchor manipulations may reflect to some extent an end-of-scale effect which results from reliance on a response scale bounded by zero and one. A related consideration is the tendency for subjects to avoid the ends of response scales, apparently for fear that they will "run out of room." Moreover, it is possible to account for the relative extent of belief revision for anchors of various sizes by something other than the contrast/surprise model. For example, "splitting the difference" between the current anchor and 1.00 or zero (or some other *post hoc* heuristic) could conceivably "explain" the subjects' mean adjustments. It is important to note, however, that the order and presentation mode effects predicted by the model cannot be similarly explained by a "splitting-the-difference" heuristic. As we discuss throughout the paper, the model's order and presentation mode predictions, not its anchor predictions, are our primary concern.

Results. The manipulation of the strength of evidence was again successful. The median numbers of points assigned to the two pieces of strong evidence were 30 and 35, while the median numbers assigned to the weak evidence were 10 and 20. Mean belief change for anchors of .20, .50, and .80 was −.077, −.228, and −.361, respectively. Note that negative numbers indicate decreases from the anchors, which is appropriate for negative evidence. The anchor effect, from a two-way ANOVA with 17 subjects per cell, is highly significant ($F=22.18$; $p<.001$), supporting Einhorn and Hogarth's contention that larger anchors are "hurt" more by negative evidence than smaller ones.

Mean belief change in the SSWW (WWSS) order was −.203 (−.240), which is not significant ($F=1.14$; $p=.288$). Therefore, the discounting model's prediction of no order effect for consistent negative evidence is supported. Finally, the anchor × order interaction is not significant ($F=0.28$; $p=.754$), also as predicted by the model.

Experiment 2A

Experiment 2A involved sequential processing of mixed evidence, and the principal issue was the recency effect predicted by the model. Specifically, the model predicts that negative evidence which is received after positive evidence will result in greater discounting, and that positive evidence which is received after negative evidence will result in a greater increase in beliefs, because of the contrast effect. The anchor was also manipulated to test the notions that larger anchors are hurt more by negative evidence than smaller ones and that smaller anchors are helped more by positive evidence than larger ones.

Design. As in Experiments 1A and 1B, subjects were asked to assume they were investigating the payroll records of an audit client. Again, they were given an anchor of .20, .50, or .80 which, based on a preliminary investigation, represented the likelihood the internal controls would prevent or detect material error. This was followed by sequential presentation of positive and negative evidence, which read as follows:

> The names on the payroll are checked periodically against the active employee file of the personnel department.
>
> The duties of those employees who prepare the payroll are rotated on a frequent basis.
>
> Formal procedures have *not* been established for changing names on the payroll, pay rates, or deductions.
>
> The payroll is *not* audited periodically by the internal auditing department.

Notice that the first two items represent strengths of the internal control system (positive evidence), while the latter two represent weaknesses (negative evidence). The results of Ashton and Brown [1980] indicate that these four pieces of evidence are viewed as approximately equally important.

Two orders of presentation were used: the two pieces of positive evidence followed by the two pieces of negative evidence (+ + − −), and the two pieces of negative evidence followed by the two pieces of positive evidence (− − + +). The order of presentation for the two positive items, and for the two negative items, was the same in both presentation orders. After each piece of new evidence was presented, subjects revised their beliefs following the same procedure as in Experiments 1A and 1B.

Three steps were taken to encourage subjects to code the positive evidence as positive and the negative evidence as negative. First, before being presented any evidence, subjects were told that "the *presence* of certain internal control factors should *increase* your confidence that the system will prevent or detect material error, while the *absence* of those factors should *decrease* your confidence." Second, when negative evidence was presented the word "not" was underlined. Finally, after each piece of evidence was presented subjects were told, "You consider this a strength (or weakness) of the system." Nevertheless, we included a manipulation check by listing the four pieces of evidence (in a $+ - + -$ order) at the end of the experiment, and asking subjects to check whether each represented a strength or weakness of internal controls.

Results. Only nine of 384 responses (96 subjects × 4 responses each) suggested coding errors, and eight of these nine related to the second piece of positive evidence, which was coded as negative. Because of the extremely small percentage of such errors, we view the manipulation of positive and negative evidence as successful. The grand mean of the belief change (i.e., over all 96 subjects) was $-.035$, which suggests that, on average, the total impact of the evidence was negative. The means for subjects receiving anchors of .20, .50, and .80 were .043, $-.028$, and $-.118$, respectively, and the anchor effect was significant ($F=11.29$; $p<.001$). Thus, as in Experiment 1B, larger anchors were hurt more by negative evidence than smaller ones. In fact, the smallest anchor (.20) was *increased*, on average, after the evidence was processed.

The effect due to the order of presentation of the evidence indicates recency, as predicted by the model. Mean belief change in the $+ + - -$ $(- - + +)$ order was $-.070$ (.002), which is significant ($F=6.76$; $p=.011$). The anchor × order interaction was not significant ($F=0.04$; $p=.959$), also as predicted by the model.

Experiment 2B

Experiment 2B also examined the sequential processing of mixed evidence. Unlike Experiment 2A, which was cast in a payroll internal control setting, Experiment 2B was cast in a receivables setting. Because of the nature of the evidence provided in the two scenarios, we expected the recency effect to be stronger in Experiment 2B than in Experiment 2A (Einhorn and Hogarth [1985, p. 13]).

Design. Experiment 2B involved internal controls over the sales-receivables-collection cycle instead of over payroll, and was based on the following evidence:

> In processing customer orders, credit approval is adequately segregated from the handling of cash receipts, as well as from the recordkeeping and sales functions.
>
> The billing function is adequately segregated from the handling of cash receipts.
>
> The handling of cash receipts is *not* adequately segregated from the accounts receivable recordkeeping.
>
> Sales returns and credits are *not* properly authorized.

Notice that all four items refer to some aspect of segregation of duties. Prior research suggests that auditors consider segregation of duties a critical internal control feature in the sales-receivables-collection cycle (e.g., Joyce [1976]). After each piece of evidence was presented, the statement, "You consider this an important strength (or weakness) of the system," was included to emphasize that the evidence was strongly positive (or negative). Aside from the change in context, Experiments 2B and 2A were identical.

Results. The results of the manipulation check indicated that only 10 of 384 responses (96 subjects × 4 responses each) involved coding errors, and none of the four pieces of evidence gave rise to a disproportionately large number of such errors. Again, we view the manipulation of positive and negative evidence as successful. The results in Experiment 2B were virtually identical to those in Experiment 2A. Overall, the total evidence was seen as negative (grand mean $= -.039$). The mean belief change for anchors of .20, .50, and .80 was .086, $-.043$, and $-.158$, respectively, and the anchor effect is significant ($F=14.42$; $p<.001$). The mean for the $++--$ $(--++)$ order was $-.086$ (.009), which is also significant ($F=6.44$; $p=.013$). This latter result supports the model's prediction of a recency effect.[8] Finally, the interaction term again failed to reach conventional levels of significance ($F=2.40$; $p=.097$), as predicted by the model.

Experiment 3

The purpose of Experiment 3 was to examine "dilution." Recall that the model predicts that sequential evaluation of consistent negative (positive) evidence will result in less extreme belief change than simultaneous processing of the same evidence, when the individual's attitude toward evidence is disconfirmation (confirmation) avoiding. When the attitude is disconfirmation or confirmation prone, however, less extreme belief change is predicted for simultaneous processing. Finally, a disconfirmation or confirmation *neutral* attitude would lead to a prediction of no difference in belief change between sequential and simultaneous processing.

In this experiment we (1) control the presentation mode, (2) observe which mode is associated with less extreme revisions (if either), and (3) infer whether the subjects have evidence-avoiding, evidence-prone, or evidence-neutral attitudes. The effect of interest is the *interaction* between direction of evidence and presentation mode. An interaction that reveals lower (higher) assessed likelihoods for positive (negative) evidence with sequential, rather than with simultaneous, presentation implies evidence-avoiding attitudes. That is, given a common anchor, or prior belief, for subjects receiving positive or negative evidence, a lower (higher) revised likelihood for positive (negative) evidence implies that the evidence had less effect on, or "diluted," the revision. In contrast, if this pattern of results is found with simultaneous processing, evidence-prone attitudes are implied. Finally, no interaction implies evidence-neutral attitudes. This approach to inferring evidence attitudes assumes, of course, that the contrast/surprise model is a valid representation of the subjects' belief-revision processes, an assumption which is supported by the results of our first four experiments.

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[8] A nonparametric analysis was performed to examine the possibility that this result could be due to extreme observations in either treatment group. A count of subjects in each group whose revisions were above and below the median found that 19 (29) subjects in the $++--$ group were above (below) the median, while the opposite proportions (i.e., 29 above and 19 below) obtained in the $--++$ group. This pattern is consistent with the model's predictions and with the analysis based on means reported in the text. Application of the medians test (Siegel [1956]) reveals that the difference between groups is significant at the .05 level via a one-tailed χ^2 test. We repeated this analysis, comparing values above and below the median, for all the other experiments as a check on the ANOVA results, and found results consistent with those reported in the text.

Design. Subjects were asked to assume they were investigating the accounts receivable balance of an audit client. They were told that a review of the internal controls in the sales-receivables-collection cycle suggested that the likelihood the accounts receivable balance was "fairly stated" was .50. (Thus, all subjects received the same anchor in this experiment.) Subjects were further told that the client has 15 customers to whom it sells on credit, and that confirmation requests had been sent to all of them. These requests asked the customers to respond by stating whether they agreed or disagreed with the balances in their accounts as reflected in the client's records.

Two factors were manipulated, each at two levels. The evidence was manipulated as consistently positive (all respondents agree with the reported balance) or consistently negative (all respondents disagree). In addition, both simultaneous and sequential presentation modes were used. In the *simultaneous* condition, subjects were told, "Later in reviewing the progress of the audit, you find that four replies have been received so far." They were then told that all four replies agreed (or disagreed) with the reported balance, and they were asked to state their revised likelihoods that the client's accounts receivable balance is fairly stated. The procedure was the same in the *sequential* condition, except that the four replies were received one at a time, and subjects revised their beliefs after each piece of evidence was received.

Results. The data were analyzed via a 2 (direction of evidence) × 2 (presentation mode) ANOVA, with 14 subjects per cell. The direction of the evidence produced a highly significant effect ($F = 103.71$; $p < .001$), as expected. Subjects receiving positive evidence increased their likelihoods, on average, from .50 to .569, while those receiving negative evidence decreased their likelihoods, on average, from .50 to .330. The main effect for presentation mode did not reach conventional levels of statistical significance ($F = 3.62$; $p = .063$): The mean response in the simultaneous (sequential) condition was .471 (.427).

With respect to the dilution effect, the main prediction of interest is an interaction between presentation mode and the direction of the evidence. A highly significant interaction was found ($F = 11.32$; $p = .001$), and its form revealed that the revisions were diluted for the *simultaneous* processing of both positive and negative evidence. This effect can be seen in Figure 2: In the sequential condition, the mean upward (downward) revision is .086 (−.232), whereas in the simultaneous condition the means are .051 (−.109). Thus, the latter revisions are "diluted" relative to the former.[9]

DISCUSSION

The present research addresses basic issues about auditors' belief revisions in simplified settings. Follow-up studies that progress toward actual auditing contexts may have important implications for audit efficiency and effectiveness, particularly with respect to the

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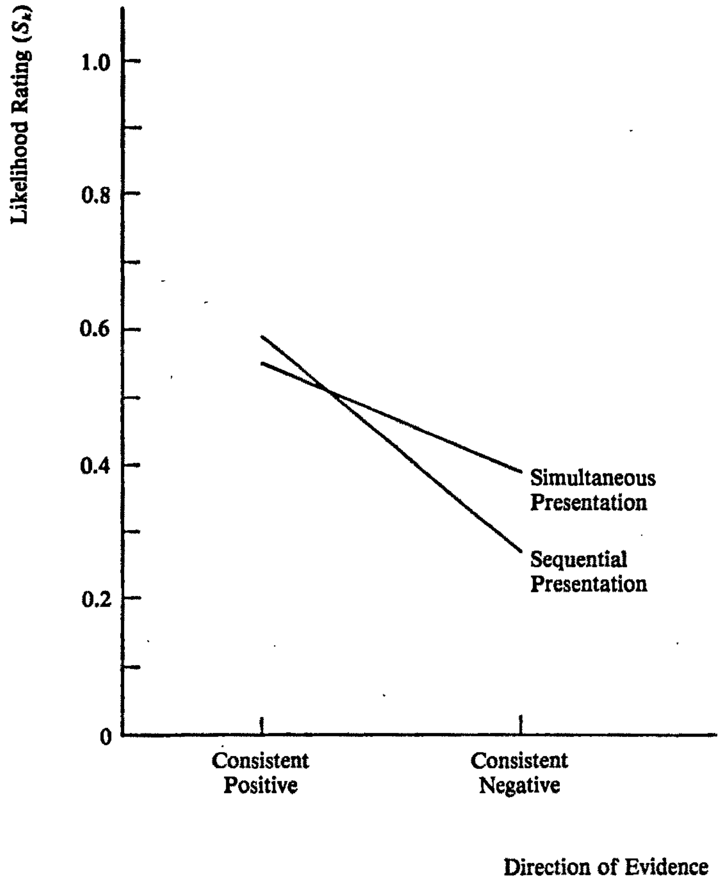
[9] The results presented in the text for Experiment 3 reflect elimination of nine auditors' responses. Four responses were eliminated because we judged them to be unreasonable (at best). One subject, for example, increased his or her likelihood rating from .50 to .80 after receiving four pieces of negative evidence, and another decreased his or her rating from .50 to .30 after receiving four pieces of positive evidence. The other five responses were eliminated randomly to achieve equal cell sizes. We repeated the analysis leaving the responses of the four questionable subjects in (and randomly eliminating an additional four to maintain equal cell sizes). The dilution effect discussed in the text was still present, but the significance level changed from .001 to .052. The mean upward (downward) revision in the sequential condition was .048 (−.207), whereas the means were .051 (−.084) in the simultaneous condition. Thus, the effect was due to the negative evidence only.

FIGURE 2
THE "DILUTION EFFECT" IN EXPERIMENT 3



amount of evidence collected to support the audit opinion. If auditors' belief revisions depend on such factors as order and presentation mode, then the cost and/or quality of audits could be affected by these normatively irrelevant aspects of evidence. If the influence of such factors were random, they would be difficult to identify and control in an actual audit. The results of our experiments suggest that the influence of such factors is not random, but systematic and predictable.

In particular, our results are consistent with the predictions of the contrast/surprise model. Experiments 1A and 1B tested the accretion and discounting models' predictions of no order effect for consistent positive and consistent negative evidence. No significant order effects were found. Experiments 2A and 2B tested the mixed evidence model's prediction of recency effects for mixed evidence. Significant recency effects were found in both experiments. The results from Experiments 2A and 2B provide stronger support for the model than the results from Experiments 1A and 1B, since the presence instead of the absence of an effect was predicted. In sum, our first four experiments provide strong support for the order effects (and lack thereof) predicted by the contrast/surprise model.

While significant order effects were not found in Experiments 1A and 1B, as predicted, it is interesting to note that the directional effects in both experiments suggest recency. Observe that an important distinction between Experiments 1A and 1B, on the one hand, and Experiments 2A and 2B, on the other, is the difference between the nature of the additional evidence presented (strong versus weak in Experiments 1A and 1B, but positive versus negative in Experiments 2A and 2B). An order-effects model that simply predicted recency regardless of whether the evidence was consistent or mixed would predict a larger effect in the latter two experiments than in the former two. While the Einhorn and Hogarth model predicts no order effect for consistent evidence, an alternative hypothesis that cannot be rejected by the present results is that of recency effects which were not sufficiently large to be detected by the tests in Experiments 1A and 1B.

Experiment 3 revealed significant dilution effects in the form of less extreme belief revisions with simultaneous than with sequential processing. These effects can be explained by equation (8), which shows that an individual's attitude toward evidence must be disconfirmation prone ($0 \leq \alpha < 1$) for negative evidence and confirmation prone ($0 \leq \beta < 1$) for positive evidence for a dilution effect to occur with simultaneous processing. Thus, our results suggest that auditors are "prone" to revise their beliefs when new evidence is received.

In contrast, the behavioral decision theory literature suggests that subjects typically tend to "avoid" new evidence. Consider, for example, the phenomena of conservatism in belief revision [Edwards, 1968] and initial belief perseverance in the face of discrediting evidence [Ross, Lepper, and Hubbard, 1975].

Is it reasonable to believe that our subjects may be characterized by evidence-prone attitudes? We believe it is, because of the nature of auditing and the education and training that auditors receive. Auditing is often conceptualized as an evidence collection/evaluation process in which beliefs about financial statement assertions are revised on the basis of new evidence. Therefore, we might expect auditors to be prone to adjust their beliefs when additional evidence is received.

The extent to which evidence-proneness is a stable characteristic of auditors is a significant area for future research. For example, if it were established that auditors display evidence-prone attitudes when making audit-related judgments, but display evidence-avoiding attitudes when making nonaudit-related judgments, this could be a critical step toward understanding the nature of expertise in audit judgment. Similarly, if subsequent research were to establish that auditors are consistently evidence-prone in both auditing and nonauditing settings, while other types of experts are not, this could have considerable implications concerning the effects of audit training.

In addition to evidence-proneness, our results suggest another way in which audit judgment may differ from judgment in general. Specifically, our subjects were influenced more by disconfirming than by confirming evidence. In contrast, research in behavioral decision theory has found the opposite: a stronger tendency for people to seek and use evidence that confirms a current belief (see, e.g., Einhorn and Hogarth [1978], Fischhoff and Beyth-Marom [1983], Klayman and Ha [1987]).

Note, however, that the nature of auditing is such that it is appropriate for negative evidence to be given more weight than positive evidence, since the primary risk that auditors face is that errors in financial statements may go undetected. In the context of Experiment 3, for example, finding that confirmation replies *disagree* with the reported balance should be more important in evaluating the assertion that accounts receivable is fairly stated than finding that the replies *agree* with the reported balance. Stated differently, the attitude toward negative evidence should be stronger than the attitude toward positive evidence (i.e., $\alpha<\beta$), and auditors should be more prone to disconfirm a hypothesis about fair presentation than to confirm it.

Figure 2 shows that this occurred in Experiment 3: The mean revision made by auditors receiving confirming evidence was .069, while the mean revision made by auditors receiving disconfirming evidence was −.170. In other words, although our subjects were prone to adjust their beliefs in *both* directions when evidence was received, they were more prone to adjust downward than upward. Like the finding of evidence-proneness, the finding of greater sensitivity to negative than to positive evidence is an important area for further research.[10]

While it might be reasonable to believe that our subjects may have possessed both disconfirmation-prone and confirmation-prone attitudes toward evidence, and that the former were stronger than the latter, we do not press this argument for two reasons. First, it is possible to explain *any* result from a dilution experiment by assuming some range of values for α and β. An alternative approach to examining the dilution effect would be to compare two judgment tasks which are expected *ex ante* to result in confirmation-prone and disconfirmation-prone behavior. An even more satisfactory approach would be to first measure α and β independently for each subject and then predict the form of the dilution effect, if any, that would be expected to occur.[11]

Second, our experiments involved no explicit incentives: Our subjects were not rewarded for "good" revisions nor penalized for "bad" ones, and there was no competition among subjects such as that which might exist in a firm or market setting. The extent to which evidence-proneness and evidence-avoidance are characteristics of the individual—as opposed to being determined by incentives or other features of the task setting—is not presently known. This could be an extremely fruitful area for research.

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[10] Ashton and Ashton [1988] present a series of experiments involving auditors and business executives, in which both evidence-proneness and the relative sensitivity to negative and positive evidence are examined.

[11] The difficulties in doing this should not be underestimated. The literature in psychophysical measurement, in which subjective intensity is shown to increase as power functions of physical intensity, contains an ongoing debate about such exponents (e.g., Poulton [1979], Stevens [1971], Teghtsoonian [1971]). The basic question is whether the exponents represent stable characteristics of individuals, or are simply artifacts of the experimental tasks and procedures involved in their measurement (e.g., the range of stimuli presented). Any attempt at independent measurement of the α and β parameters in the contrast/surprise model is likely to face similar difficulty. Without such attempts, however, it is not clear how one would construct a direct test of dilution effects.

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NOTES

Accounting Changes: Successful Versus Unsuccessful Firms

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ABSTRACT: Both descriptive and statistical analyses of the pattern of accounting changes of successful and unsuccessful firms indicate that unsuccessful firms are more likely than successful firms to make accounting changes that increase income. Sample firms are matched by industry membership to control for macroeconomic factors. Success is measured by the total market return to shareholders over a ten-year period. The empirical findings are consistent with the assertion that managers can modify reported income through judicious accounting changes.

CHANGES in accounting principles and estimates often produce dramatic differences in reported income. *The Wall Street Journal* [January 25, 1980, p. 4] implies that these accounting changes are usually made to mask performance problems. In a similar vein, academic research[1] argues that managers change accounting principles and estimates to satisfy managerial goals such as income smoothing or the reduction of agency costs.

In the short run, judicious use of changes in accounting principles and estimates can allow firms to improve or smooth income and to increase net assets and equity. From an agency perspective, an income enhancing change in principle or estimate will enhance the probability of compliance with debt covenant financial ratios which are typically expressed in terms of debt divided by equity.

However, accounting regulators have attempted to reduce managements' ability to increase income through account-

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[1] Firms with unsuccessful operations are more likely to have higher debt to equity ratios and approach the point where debt covenant restrictions become binding. Prior research has hypothesized that as the tightness of debt covenants increases, firms are more likely to loosen the tightness of covenant constraints through appropriate accounting choices. Studies that deal with this general hypothesis include Ayres [1986], El-Gazzar, Lilien, and Pastena [1986], Daley and Vigeland [1983], Lilien and Pastena [1982], Bowen, Noreen, and Lacey [1981], and Zmijewski and Hagerman [1981]. Positive accounting theory is extensively reviewed in Watts and Zimmerman [1986].

Ronen and Sadan [1981] summarize the literature on income smoothing. The main development of this line of research is the increasing recognition that management can affect reported earnings in many ways including transactions with suppliers and creditors, avoidance of discretionary expenditures, choice of accounting principles, and classification of income and expense items.

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ing changes. Pronouncements of the Accounting Principles Board (APB), the Financial Accounting Standards Board (FASB), and the Securities and Exchange Commission (SEC) have (1) increased disclosure of the effects of accounting changes in principles and estimates and (2) reduced managerial flexibility in making these changes.

For example, APBO No. 20, effective 1971, mandates justification of accounting changes and disclosure of their effects on the financial statements. Also, APBO No. 20 limited the ability of some accounting changes (for example, changes from LIFO to another inventory method) to affect current income by mandating retroactive rather than current recognition of prior period effects of the change. Even when the prior effects of accounting changes are included in current income, APBO No. 20 requires the segregation of this "cumulative effect of accounting change" from income from continuing operations.

The SEC's Accounting Series Release (ASR) No. 177 has the potential to reduce managerial flexibility in making accounting changes because of its mandate that accounting changes be made to more preferable accounting methods. ASR No. 177 states that the choice of a more preferable method must be consistent with reasonable business judgment, although no exact definition of this term is given in the Release or any subsequent SEC pronouncement. ASR No. 177 also requires that registrants provide justifications for their "preferable" accounting changes in the notes to the financial statements; thus, the "preferable" accounting change must be reviewed by the registrant's independent auditors.

This research constructs groups of successful and unsuccessful firms as measured by market returns over a ten-year period and contrasts the patterns of their accounting changes over this period. Hypothesized group differences in the effect on income of accounting changes are tested. The basic finding is that unsuccessful firms are more likely than successful firms to improve income through accounting changes. This is consistent with the assertion that managers retain substantial flexibility despite regulations of the APB, FASB, and SEC.

Successful Versus Unsuccessful Economic Performers

Strong and weak economic performers are defined on the basis of total market return to investors for the ten-year period of 1974 through 1983 as reported in *Fortune* magazine [April 30, 1984]. *Fortune*'s total market return to investors (p. 233) includes both price appreciation and dividend yield to an investor in the company's stock. The return figures assume the sale at the end of 1983 of stock owned at the end of 1973. It is assumed that proceeds from cash dividends, sale of rights and warrant offerings, and stock received in spinoffs were reinvested at the end of the year in which they were received. Returns are adjusted for stock dividends, stock splits, recapitalization, and corporate reorganizations as they occur.

Fortune indicated that 23 nonfinancial industries contained at least four firms. The top two firms on the basis of total market return in each of these 23 industries constitutes a group of 46 successful firms. The two lowest rated firms on the basis of total market return in each of these 23 industries constitutes a group of 46 unsuccessful firms. The changes in accounting methods and estimates of these groups of 46 successful and 46 unsuccessful firms are analyzed over the same ten-year period, 1974 to 1983, conforming to the ten-year market rate of return period used in *Fortune*. The choice of 1974 as a starting point is appropriate because APBO No. 20 was fully operative by that date.

Given that these groups of successful and unsuccessful firms are balanced by industry membership, macroeconomic factors should have similar effects on industry members. Therefore, differential changes in accounting principles and estimates across the two groups should reflect managerial responses to firm specific issues.

HYPOTHESES

The financial press, income smoothing theory, and agency theory imply that financially troubled firms are likely to use reporting flexibility to enhance income and net assets. Successful firms do not have similar motivations to improve income and asset balances because normal operations will produce accounting numbers that insure compliance with financial covenants. Similarly, from an income smoothing perspective, firms with successful operations do not have incentives to enhance already high income because very high levels of income growth may be difficult to sustain indefinitely.

The difference in incentives for successful versus unsuccessful firms leads to the general alternative hypothesis that unsuccessful firms are more likely than successful firms to make accounting changes that increase income. The null form of this hypothesis implies that with regulation reducing financial flexibility, the directional effect of accounting changes on income will be driven by unspecified variables presumed to be randomly spread across the two subgroups. The null hypothesis assumes that the (potential) income effect of accounting changes should be essentially the same for either type of firm.

H_1: The proportion of accounting changes that increase income of successful firms will equal or exceed the proportions for unsuccessful firms. The alternate is that unsuccessful firms will make proportionately more income enhancing accounting changes as compared to successful firms.

H_1 is stated to encompass all reported accounting changes. However, the period of 1974 to 1983 was one of high inflation. The substantial increase in the inflation rate as compared with the prior years may have motivated specific accounting changes such as LIFO adoption. Similarly, during this period pension funds earned rates of return that were substantially higher than those previously assumed. *Ceteris paribus*, higher return assumptions lower pension expense. Insofar as the changes to LIFO and changes in pension assumptions reflect the high inflation of the sample period, these accounting changes may be viewed as less discretionary than changes in methods of asset valuation or changes in the method of revenue or expense recognition.

Thus, H_2 relates to the "more" discretionary accounting changes by excluding changes to LIFO and pension accounting changes.

H_2: The proportion of non-LIFO and non-pension accounting changes that increase income of successful firms will equal or exceed the proportions for unsuccessful firms. The alternate is that unsuccessful firms will make proportionately more income enhancing non-LIFO and non-pension accounting changes as compared to successful firms.

TABULATION OF ACCOUNTING CHANGES

The tabulations of accounting changes include both changes in principles and changes in estimate. We do not distinguish between these two forms of changes because, as explained in APBO No. 20, distinguishing between a change in accounting principle and a change in accounting estimate is sometimes difficult. In particular, APBO No. 20 (par. 11) states that for some accounting changes "the effect of the change in accounting principle is inseparable from the effect of the change in accounting estimate."

In fact, many of the changes made by the sample firms seem to have at least an element of a change in estimate. This is especially true for some of the changes in pension accounting. Elimination of these changes in estimates would produce a sample of changes that does not represent the spectrum of managerial discretion.

Table 1 lists the accounting changes by the sample firms, and their effects on income. The 46 successful firms made 35 accounting changes. Fourteen of the changes increased income while 21 decreased reported income. Thirty-one of these 35 changes by successful firms represent changes to LIFO or pension changes; thus, only four changes by the successful firms represent revaluations of net assets or changes in the pattern of revenue or expense recognition. These four changes had a negative impact on income.

Table 1 also indicates that the 46 unsuccessful firms made 80 accounting changes. Forty-seven of these changes had a positive effect on income and 33 negative. Twenty of these 33 negative changes by unsuccessful firms represent tax motivated changes to LIFO and five others are pension accrual changes.

Test of Hypotheses

The only requirements needed in nonparametric testing are that the observations be independent of each other and that the sign of a given data point be observable [Siegel, 1956, p. 31]. The issue of independence of observations is addressed by defining the observations in three different ways. In the all-change approach, every accounting change is treated as an independent observation. This assumes that a firm's making an accounting change in a given year does not change the probability of that firm making other accounting changes in that same year.

Some may argue that firms with negative change may find a positive change to offset it. Others may argue that firms may desire to lower income in a very poor year by making multiple negative changes in order to set the stage for a future recovery. In either case, the accounting changes in a given year will not be independent of each other. A solution is to net the impact of all of a given firm's accounting changes during the year. This allows a maximum of one observation per firm in a given year and is called the firm-year approach. There is no reason to believe that independence of observations is a problem when using this approach because the interactive effect that changes in a given year might have on one another is confined to one observation.

While independence should not be a problem in the firm-year approach, it is possible that results will be dominated by those firms that made changes in a number of different years. This problem can be avoided by treating the total effects of all accounting changes made by a given firm as one observation. Using this total-effect approach, a given firm cannot be counted more than once. As in the case of the firm-year approach,

TABLE 1

ANALYSIS OF CHANGES FOR SUCCESSFUL AND UNSUCCESSFUL COMPANIES BY INDUSTRY

Fortune *Industry/Company*	*Successful/ Unsuccessful*	*Year*	*Nature of Change*	*Percent*
MINING (10)				
Mitchell Energy & Development	S		None	
Vulcan Materials	S	1974	To LIFO	−13.0
Amax	U	1978	Actuarial	4.2
Inspiration Resources	U		None	
FOOD (20)				
Dean Foods	S		None	
Conagra	S	1981	Actuarial	1.1
McCormick	U	1980	To LIFO	−19.8
		1981	Actuarial	3.7
		1982	Actuarial	3.1
Central Soya	U	1981	Actuarial	.2
TEXTILES (22)				
Collins & Aikman	S		None	
West Point Pepperell	S	1978	To LIFO	−3.0
Armstrong World Industries	U	1981	Actuarial	9.4
United Merchants & Manufacturing	U	1980	Actuarial	2.4
APPAREL (23)				
Oxford Industries	S	1983	Actuarial	.9
Palm Beach	S	1974	To LIFO	−43.0
		1976	Actuarial	−4.0
Interco	U		None	
Kellwood	U	1981	ITC to Flow-Through	172.8
		1981	To LIFO	−35.2
		1982	Actuarial	8.5
		1983	Actuarial	2.0
PAPER (26)				
Stone Container	S	1981	Actuarial	.6
		1982	Actuarial	3.7
James River Corp.	S		None	
Georgia Pacific	U	1974	To LIFO	−15.0
		1982	ITC to Flow-Through	565.2
Weyerhaeuser	U	1980	Actuarial	7.0
		1982	Chg. in Erta Benefits	36.4
PUBLISHING (27)				
Meredith	S	1978	Useful Life	−4.6
Washington Post	S	1979	Accounting for subscriptions	−40.0
Macmillan	U	1975	Revenue Recognition	−77.0
		1979	Change in advertising expense	−11.3
		1979	Change to LIFO	−3.7
		1979	Change in depreciation	−18.6
		1979	Change in vacation	−2.4
		1980	Change in prepublication cost	−135.8
American Greetings	U	1983	Actuarial	.3
CHEMICALS (28)				
H. B. Fuller	S		None	
Tyler	S	1974	To LIFO	−16.0
Hercules	U	1974	Actuarial	−18.0
		1974	To LIFO	−5.0
		1980	Actuarial	6.2
		1981	Change in inventory	3.9
		1982	Actuarial	15.2
Williams Companies	U	1980	To LIFO	−7.8
		1983	Actuarial	3.8

TABLE 1—*Continued*

Fortune *Industry/Company*	*Successful/ Unsuccessful*	*Year*	*Nature of Change*	*Percent*
REFINING (29)				
Witco Chemical	S	1981	Actuarial	1.0
		1983	Actuarial	2.3
Crown Central Petroleum	S	1980	To LIFO	−40.0
Kerr McGee	U	1977	Change in estimated losses	1.0
Tosco	U	1974	To LIFO	−34.0
		1981	Actuarial	124.2
		1982	Useful Life	.9
RUBBER (30)				
Cooper Tire & Rubber	S		None	
Dorsey	S	1982	Actuarial	5.0
Dayco	U	1982	Actuarial	90.0
Rubbermaid	U		None	
GLASS (32)				
Moore McCormach Resources	S	1974	To LIFO	−6.0
PPG Industries	S	1983	Actuarial	4.1
Corning Glass Works	U	1982	Actuarial	−15.0
Manville	U	1981	Actuarial	7.8
METAL MANUFACTURING (33)				
Worthington Industries	S	1976	Depreciation	−22.0
Nucor	S		None	
Revere Copper & Brass	U	1980	Partial to LIFO	−11.4
		1982	Actuarial	1.3
		1983	Partial to LIFO	−28.3
Phelps Dodge	U	1979	Actuarial	3.1
		1980	To LIFO	−3.7
		1982	Actuarial	2.0
METAL PRODUCTS (34)				
H. H. Robertson	S	1974	To LIFO	−30.0
Ball	S	1983	Actuarial	−1.2
Crown Cork & Seal	U		None	
CBI Industries	U	1974	To LIFO	−5.5
		1979	Actuarial	−1.3
		1983	Actuarial	9.5
		1983	Depreciation Method	7.4
ELECTRONICS (36)				
E-Systems	S	1982	Actuarial	2.1
Bairnco	S		None	
Singer	U	1982	Actuarial	59.2
		1982	Chg. Est. of Restructuring	222.2
Penn Central	U		None	
SHIPBUILDING (37)				
Coachmen Industries	S		None	
Fleetwood Enterprises	S		None	
ACF Industries	U	1980	Actuarial	4.4
		1980	Useful Life	17.9
Allied	U	1974	To LIFO	−23.0
		1980	Useful Life	−1.9
		1983	ITC to Flow-Through	66.1
SCIENTIFIC EQUIPMENT (38)				
Lear Siegler	S		None	
Ametech	S		None	
Xerox	U		None	
AM International	U	1977	Change in Vacation Pay Accrual	−37.8
		1977	To LIFO	−11.7
		1981	Actuarial	1.1

TABLE 1—*Continued*

Fortune Industry/Company	*Successful/ Unsuccessful*	*Year*	*Nature of Change*	*Percent*
VEHICLES (40)				
Sealed Power	S	1979	To LIFO	−15.0
		1980	To LIFO	−2.3
Sheller Globe	S	1982	Actuarial	5.2
American Motors	U	1977	Tax	9.9
		1980	Actuarial	4.0
International Harvester	U	1977	Change in Estimated Losses	1.2
		1977	Change in Product Cost	−2.8
		1978	Change in Estimated Losses	2.2
		1978	To LIFO	−6.1
		1982	Actuarial	8.5
		1983	LIFO to Avr. Cost	17.2
AEROSPACE (41)				
Lockheed	S	1977	Actuarial	−5.7
		1979	Actuarial	−43.5
		1980	Actuarial	36.6
Boeing	S		None	
McDonnel Douglas	U		None	
Rohr Industries	U	1981	Actuarial	41.8
DRUGS (42)				
Cooper Labs	S		None	
Abbott Laboratories	S		None	
Eli Lilly	U	1980	To LIFO	−4.9
Schering Plough	U	1980	To LIFO	−3.7
		1981	Actuarial	1.4
		1983	Actuarial	1.2
SOAPS (43)				
Clorox	S	1980	To LIFO	−6.9
		1983	Actuarial	2.5
Chesebrough Pond's	S	1983	Actuarial	1.4
International Flavors	U		None	
Avon Products	U		None	
COMPUTERS (44)				
Wang Products	S		None	
Pitney Bowes	S	1980	To LIFO	−3.2
		1982	Actuarial	.7
Nashua	U		None	
Archer Daniels	U	1979	To LIFO	−7.2
		1981	To LIFO	−6.4
INDUSTRIAL (45)				
Teledyne	S		None	
Colt Industries	S	1981	Useful Life	−5.4
Bucyrus-Erie	U	1979	Actuarial	−2.2
Ingersoll Rand	U	1979	Actuarial	−.2
LEISURE (47)				
Hillenbrand Industries	S		None	
Kidde	S		None	
Mattel	U	1982	Actuarial	1.9
AMF	U	1974	To LIFO	−40.0
		1981	ITC to Flow-Through	40.2
		1982	Actuarial	5.6
		1983	Actuarial	47.2

TABLE 1—*Continued*

Fortune Industry/Company	*Successful/ Unsuccessful*	*Year*	*Nature of Change*	*Percent*
BEVERAGE (49)				
G. Heileman	S	1974	To LIFO	−7.0
MEI	S	1974	To LIFO	−13.0
Dr. Pepper	U	1980	To LIFO	−2.5
Coca Cola	U	1981	Actuarial	.3

observations should be clearly independent of each other and the assumptions of the nonparametric tests are met unambiguously.

Tests of H_1

Table 2 provides the results of the Chi-square tests of H_1. Panel A of Table 2 reports the results of the all-change approach where each accounting change is treated as an observation. Among the successful firms, only 14 of the 35 accounting changes had a positive effect on income while among the unsuccessful firms 47 of the 80 changes had a positive income effect. This results in a Chi-square of 2.725 (one degree of freedom) which is significant at the 0.05 level[2] in a one-tail test. Thus, we can reject the null of no difference in direction among the two groups and accept the alternative of income enhancing behavior by unsuccessful firms.

Panel B of Table 2 shows that the results do not change when the firm-year approach is used. In this approach, multiple changes by a given firm in the same year are netted so a firm can contribute a maximum of one observation in a given year. The successful firms had only 14 positive firm-years and 21 negative while the unsuccessful firms had 42 positive firm-years in contrast to 27 negative firm-years. The Chi-square statistic of 3.273 (one degree of freedom) indicates acceptance of the alternative hypothesis of differential behavior between groups at the 0.05 level of significance in the one-tail test.

Panel C of Table 2 indicates that the alternative hypothesis, also, must be accepted when the total-effect approach is used. Among the successful firms, the total effect of accounting changes over the ten-year period is positive for nine firms and negative for 18 firms. Among the unsuccessful firms, the total effect of accounting changes is positive for 24 firms and negative for 13 firms. This produces a Chi-square statistic of 5.015 (one degree of freedom) which is significant at the 0.02 level in a one-tail test.

Contrary to expectations, under the all-change approach in panel A, the unsuccessful firms make more income reducing changes than the successful firms (33 negative changes for the unsuccessful firms versus 21 for the successful firms). However, when considering the total impact of all changes in panel C, only 13 unsuccessful firms as opposed to 18 successful firms made changes over the ten-

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[2] Interpretation of the significance level of the Chi-square statistics is based on tables provided in Siegel [1956]. The reported interpretations of significance levels are based on one-tailed tests because the alternative hypotheses are one directional in nature.

TABLE 2

THE EFFECT ON INCOME OF ALL ACCOUNTING CHANGES

Panel A: The All-Change Approach (Observations = 115)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	14	47
Negative	21	33

($\chi^2=2.725$, df = 1, One-Tail Probability = 0.05)

Panel B: The Firm-Year Approach (Observations = 104)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	14	42
Negative	21	27

($\chi^2=3.273$, df = 1, One-Tail Probability = 0.03)

Panel C: The Total-Effect Approach (Observations = 64)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	9	24
Negative	18	13

($\chi^2=5.015$, df = 1, One-Tail Probability = 0.02)

Notes: 1. Firms are defined as successful or unsuccessful on the basis of market rate of return for the period starting 12/31/73 and ending 12/31/83. Accounting changes are analyzed for that same ten-year period.

2. The All-Changes approach treats each individual accounting change as a separate observation. The Firm-Year approach treats the net income effect of all accounting changes by a firm in a given year as one observation. The Total-Effects approach treats the total income effects of accounting changes by a given firm over the ten-year period as one observation.

year sample period whose cumulative impact was income reducing.

Tests of H_2

Because a large number of accounting changes in the 1974 to 1983 period may have been direct responses to macroeconomic factors such as inflation, H_2 focuses on the changes that remain after the inflation driven LIFO and pension changes are eliminated. These remaining changes represent revaluations of net assets or changes in the pattern of revenue and expense recognition.

Because the successful firms made very few accounting changes other than LIFO or pension changes, two of the four cells in the two-by-two contingency tables in the three panels of Table 3 have less than five observations expected. When any cell in a two-by-two contingency table contains less than five observations expected, the Fisher Exact Probability test provides the precise level of significance [Siegel, 1956, pp. 96–104].

Panel A of Table 3 indicates that when using the all-change approach, all four

TABLE 3

THE EFFECT ON INCOME OF 27 OF THE NON-LIFO/NON-PENSION CHANGES

Panel A: The All-Changes Approach (Observations=27)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	0	15
Negative	4	8

(Fisher Exact One-Tail Probability=0.028)

Panel B: The Firm-Year Approach (Observations=24)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	0	14
Negative	4	6

(Fisher Exact One-Tail Probability=0.019)

Panel C: The Total-Effects Approach (Observations=19)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	0	13
Negative	4	2

(Fisher Exact One-Tail Probability=0.003)

Notes: 1. Firms are defined as successful or unsuccessful on the basis of market rate of return for the period starting 12/31/73 and ending 12/31/83. Accounting changes are analyzed for that same ten-year period.

2. The All-Changes approach treats each individual accounting change as a separate observation. The Firm-Year approach treats the net income effect of all accounting changes by a firm in a given year as one observation. The Total Effects approach treats the total income effects of accounting changes by a given firm over the ten-year period as one observation.

changes by the successful firms are negative while 15 of the 23 changes by unsuccessful firms are positive. The Fisher Exact Probability test indicates acceptance of the alternative hypothesis of income enhancing motivation by unsuccessful firms at the .028 level of significance (one tail).

Panel B of Table 3 indicates that the results are similar to those in panel A when the firm-year approach is used. The successful firms had four firm-years with a negative income effect while 14 of the 20 firm-years of the unsuccessful firms indicate a net positive effect of accounting changes. The Fisher Exact Probability test indicates acceptance of the alternative hypothesis at the .019 level of significance (one tail).

Panel C of Table 3 presents similar results when the total-firm approach is used. All four successful firms had net negative changes for the ten years while 13 of the 15 unsuccessful firms had net positive changes for the ten years. The Fisher Exact Probability test is significant at the 0.003 (one tail) level and again supports acceptance of the alternative hypothesis.

TABLE 4

THE MAGNITUDE OF THE EFFECTS OF ACCOUNTING CHANGES ON NET INCOME

Panel A: Magnitude of Income Effect by Firm Classification

Classification of Changing Firms	*Direction of Change on Income*	*Number of Accounting Changes*	*Average Income Effect of Change (Standard Deviation)*
SUCCESSFUL	POSITIVE	14	4.8 (9.28)
SUCCESSFUL	NEGATIVE	21	−15.4 (14.86)
UNSUCCESSFUL	POSITIVE	47	36.9 (90.98)
UNSUCCESSFUL	NEGATIVE	33	−18.1 (26.56)
TOTAL CHANGES		115	

Panel B: Income Effect by Type of Change for Successful Firms

Type of Accounting Change	*Number of Changes*	*Average Income Effect of Change (Standard Deviation)*
Change to LIFO	13	−13.7 (11.3)
Positive Pension Accrual	14	4.8 (9.28)
Negative Pension Accrual	4	−13.6 (20.01)
Positive Revenue/Expense Recognition Change	0	
Negative Revenue/Expense Recognition Change	4	−18.01 (16.71)
TOTAL CHANGES BY SUCCESSFUL FIRMS	35	

THE MAGNITUDE OF THE INCOME EFFECT OF ACCOUNTING CHANGES

In addition to observing the directional effect of the accounting changes, it is interesting to note the magnitude of these accounting changes on income. Panel A of Table 4 provides the mean effect on net income of all the accounting changes classified on the basis of type of firm and income direction of change. On the average, positive income changes by successful firms increased income by 4.8 percent; negative income changes by successful firms lowered income by 15.4 percent; positive income changes by unsuccessful firms increased income by 36.9 percent; and negative income changes by unsuccessful firms decreased income by 18.1 percent.

Panel B of Table 4 illustrates that income increasing changes by successful

TABLE 4—*Continued*

Panel C: Income Effect by Type of Change for Unsuccessful Firms

Type of Accounting Change	*Number of Changes*	*Average Income Effect of Change (Standard Deviation)*
Change to LIFO	20	−15.41 (12.83)
Positive Pension Accrual	32	15.06 (28.18)
Negative Pension Accrual	5	−7.34 (8.45)
Positive Revenue/Expense Recognition Change	15	78.95 (149.70)
Negative Revenue/Expense Recognition Change	8	−35.95 (47.73)
TOTAL CHANGES BY UNSUCCESSFUL FIRMS	80	

Note: Firms are defined as successful or unsuccessful on the basis of market rate of return for the period starting 12/31/73 and ending 12/31/83. Accounting changes are analyzed for that same ten-year period.

firms have a relatively small positive magnitude (4.8 percent) because they are limited to low magnitude pension accruals. In contrast, panel C of Table 4 indicates that the 15 income increasing changes of unsuccessful firms represent changes in firms' pattern of expense and revenue recognition and these 15 changes have a mean positive income effect of 79 percent.

Panels B and C of Table 4 also show that most of the accounting changes with negative income effects for both successful and unsuccessful firms are changes to LIFO which represent 20 of the changes by unsuccessful firms and 13 of the changes by successful firms. These LIFO adoptions with a mean negative income impact of 13 percent for successful firms and 15 percent for unsuccessful firms have a substantially smaller income effect than changes in the pattern of income and expense recognition.

SENSITIVITY ANALYSIS: THE ISSUE OF FIRM SIZE

Table 5 provides the 23 industry averages for the market rate of return and size. Separate figures are provided for the successful and unsuccessful firms; thus, each of the industry averages is the average of the two sample successful firms and the two sample unsuccessful firms from a given industry.

The second and fourth columns of Table 5 show the industry average rates of returns for the successful and unsuccessful sample firms. The average rate of return for the successful firms is 30.9 percent while the average rate of return for unsuccessful firms is 3.6 percent. This difference in the market rates of return for the successful versus unsuccessful groups is statistically significant at the .01 level using Wilcoxon matched-pair test.

TABLE 5
SIZE AND RETURN OF SAMPLE FIRMS BY INDUSTRY

	Successful Firms		*Unsuccessful Firms*	
Industry (Code)	*Average Returns*[1] *(Percent)*	*Average Size*[2] *(000,000)*	*Average Returns (Percent)*	*Average Size (000,000)*
Mining (10)	25	890	−1	1526
Food (20)	20	1576	5	1223
Textiles (22)	24	944	3	952
Apparel (23)	36	494	15	1569
Paper (26)	33	1155	3	5675
Publishing (27)	36	622	10	576
Chemicals (28)	29	692	3	2397
Refining (29)	21	1526	−2	3000
Rubber (30)	27	451	10	577
Glass (32)	25	2052	2	1659
Metal Manufacturing (33)	38	495	2	742
Metal Products (34)	28	729	1	1063
Electronics (36)	44	632	2	2508
Shipbuilding (37)	41	668	8	5463
Scientific Equipment (38)	30	956	−6	4513
Motor Vehicles (40)	24	515	−2	3583
Aerospace (41)	40	8809	14	4343
Drugs (42)	27	1687	−1	2420
Soaps, Cosmetics (43)	9	1299	−2	1730
Office Equipment (44)	38	1586	8	2428
Industrial/Farm Equipment (45)	37	2277	1	1412
Leisure (47)	20	1381	6	1155
Beverages (49)	41	883	4	3775
MEANS	30.9	1405	3.6	2360
STANDARD DEVIATION	8.5	1695	5.2	1531

[1] Returns are the average market returns to investors in the stock of the firm over the ten-year period of 12/31/73 to 12/31/83. Dividends, stock splits, stock dividends, etc., are considered. The numbers are obtained from the 4/30/84 issue of *Fortune*.

[2] Size is defined in millions of dollars of sales.

While the difference in the rate of return is expected, it is important to determine whether other factors might be influencing the results. Size is a possible explanatory variable for accounting changes. In fact, some have hypothesized that the largest firms may have incentives to choose accounting methods that lower income in order to reduce visibility or "political risk."

The third and fifth columns of Table 5 provide the industry average sales in millions of dollars for the successful and unsuccessful sample firms. Average sales of $1,405 million for the successful firms is substantially smaller than the average sales of $2,360 million for the unsuccessful firms. Using the Wilcoxon test, this difference is statistically significant at the .03 level. Given that size is different over the successful and unsuccessful groups, additional analysis of the pattern of accounting changes are made to determine whether size is driving the re-

TABLE 6

ANALYSIS OF THE TYPES OF ACCOUNTING CHANGES ACROSS FIRMS OF DIFFERENT SIZES

Panel A: The Total-Effects Approach for Firms Ranked in the Bottom Half of the Fortune 500 *on the Basis of Size* (Observations = 35)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	5	9
Negative	14	7

($\chi^2 = 2.115$, df = 1, One-Tail Probability = 0.07)

Panel B: The Total-Effects Approach for Firms Ranked in the Top Half of the Fortune 500 *on the Basis of Size* (Observations = 29)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	4	15
Negative	4	6

(Fisher One-Tail Exact Probability = 0.004)

Panel C: The Total-Effects Approach for Non-LIFO/Non-Pension Accounting Changes using only Firms Ranked in the Top Half of the Fortune 500 *on the Basis of Size* (Observations = 10)

Effect of Change on Current Income	*Successful Firms*	*Unsuccessful Firms*
Positive	0	9
Negative	1	0

(Fisher One-Tail Exact Probability = 0.001)

Notes: 1. Size is defined as sales.
2. See notes to Tables 2 and 3 for definitions of the Total-Effects Approach, Successful Firms, Unsuccessful Firms, and the sample period.

sult that unsuccessful firms are more likely to increase income by making income enhancing accounting changes.

Table 6 illustrates the pattern of the total effects of accounting changes of successful and unsuccessful firms when sample firms are segregated by size. The total-effect approach is used here to minimize the dependence of observations problems. Panel A uses only comparatively smaller firms (bottom half of the *Fortune 500* in sales) and illustrates a pattern of more income enhancing changes by low rate of return firms and more income reducing changes by high rate of return firms. The Chi-square statistic of 2.115 (one degree of freedom) indicates significance at the 0.07 level.

Panel B of Table 5 uses only larger firms (top half of the *Fortune 500* in sales). Panel B also illustrates a pattern of more income enhancing changes by large low rate of return firms and more income reducing changes by large high rate of return firms. Given the small number of observations in two of the cells, the Fisher Exact Probability test is used and confirms the pattern of income enhancing changes by unsuccessful firms at the 0.004 significance level. A similar (statistically significant) pattern of income enhancing accounting changes by large unsuccessful firms is found when using the largest 150 firms on the basis of sales.

More evidence is provided by replicating the analysis of accounting changes of the largest 250 firms with the LIFO and pension accrual changes eliminated. As reported in panel C of Table 5, nine of the ten remaining observations represent large unsuccessful firms that made accounting changes whose net effect was to increase income. The Fisher Exact Probability test confirms the pattern of income enhancing changes by unsuccessful firms at the .001 significance level.

These results indicate that the basic hypothesis of more income enhancing accounting changes by unsuccessful firms is confirmed across different size levels. Thus, size is not driving the reported results in Tables 2 and 3. In fact, large firms with low rates of return do not make accounting changes that reduce income and lower political visibility. Rather, these large unsuccessful firms increase income through accounting changes.

CONCLUSIONS

Both descriptive and statistical analyses of the pattern of accounting changes of successful and unsuccessful firms indicate that unsuccessful firms are more likely than successful firms to make accounting changes that increase income. Sample firms were matched as to industry membership as reported in *Fortune* to control for macroeconomic factors. The empirical finding that unsuccessful firms are more likely to make accounting changes that increase income is consistent with the assertion that managers retain considerable flexibility to modify reported income through judicious accounting changes. This tendency of unsuccessful firms to enhance income through accounting changes is observed for both the smallest and the largest firms of the *Fortune 500.*

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Popper's Methodology of Falsificationism and Accounting Research

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ABSTRACT: Popper's falsificationism is apparently being adopted as an ideal by accounting researchers. For example, Christenson [1983] has criticized Watts and Zimmerman's [1978, 1979] theories for not conforming to Popper's approach. This paper argues that Popper's falsificationism should not be viewed as an attainable ideal by accounting researchers, and that standard of rigor and research and experimental design are sufficient to support Christenson's criticisms without recourse to Popper's methodology.

POPPER'S [1959] falsificationist methodology represents an attempt to solve a particular logical problem. The problem is that observations which are in accordance with a theory cannot be taken to "confirm" or "prove" that theory. Accepting a theory because of the existence of confirming evidence commits the fallacy of "affirming the consequent" and is a well-recognized error of logic.[1] Popper's approach depends upon the point that the *falsity* of universal statements *can* be logically deduced from singular statements. Therefore, Popper prescribed that theories be negatively framed: theories should state the type of observation(s) that refute them (and, hence, would be decisive observations), rather than positively state those observations which would support or confirm them. The strength of Popper's falsificationist approach derives from the fact that, while it is logically fallacious to *affirm* the consequent, it is logically correct to *deny* the consequent (the logical rule of *modus tollens*).

The view that Popper's falsificationist

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[1] Hume [1888] first articulated the major problem that this point of logic presents for empiricism. An associated deficiency of confirmationism or verificationism, further rendering it an extremely weak form of testing, relates to the fact that every false statement has an indefinite number of factually correct consequences. Thus, there will always be many observations available to support a false theory. For example, prior to Einsteinian theory, everything in the observable world seemed to confirm Newtonian theory. In fact, as Leibniz [1677] showed, it can be logically demonstrated, that any finite number of observations can be accommodated within an indefinitely large number of different explanations. As Lakatos [1978, p. 99] states: "Creative imagination is likely to find corroborating novel evidence even for the most 'absurd' programme, if the search has sufficient drive."

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methodology represents a scientific ideal appears to be gaining popularity with accounting researchers. For example, McKee et al. [1984, pp. 647, 651-652] and Watts and Zimmerman [1986, pp. 2, 8-10, 12] make favorable references to Popper. Recently, Christenson has based a critique of work on the positive accounting theory of the Rochester School on its inconsistencies with the guidelines offered by Popper's falsificationist approach. The absence of a formal published reply—from the Rochester School or elsewhere—appears to leave the impression that it is appropriate to hold empirical work up to the standards of Popper. The purpose of this Note is to clarify the meaning of Popper's falsificationist approach and to argue that it is not a practical evaluative guideline for empirical work in accounting. It is important that these arguments be made and understood because acceptance of Popper's falsificationism as an attainable ideal and the consequent evaluation of empirical work solely from this perspective has the potential to arbitrarily and harmfully limit the nature and domain of accounting research. It is the intent of this Note to help forestall such harm. It is important to distinguish the purpose of this paper from a defense of the positive theory work that was the subject of Christenson's critique.

POPPER'S FALSIFICATIONISM: A CLARIFICATION

There appears to be confusion among accounting researchers concerning Popper's falsificationism. For example, McKee et al. [1984, pp. 651-652] state that their study represents an attempt to *refute* Watts and Zimmerman [1978]. This is not correct; their study represents an attempt to *confirm* them. In fact, they were unable to confirm them.[2] However, the failure of verificationist or confirmationist tests does not constitute a refutation or falsification of a theory.

It seems that the confusion among some accounting researchers about falsificationism stems from the belief that the framing of an hypothesis in the "null" form is a form of falsificationism. However, this is incorrect. Such framing represents merely an approach to testing samples, and represents a form of confirmationism rather than falsificationism: rejection of the null provides some support for a theory but *failure to reject the null does not imply acceptance of the null, or falsification of the theory*—it merely implies a failure to obtain confirmationist support for a theory. Indeed, testing the null hypothesis frequently represents a very weak form of confirmationism. When a test of significance rejects the null hypothesis, all that is inferred is that the obtained sample results are unlikely to have occurred by chance. Only if the experimental design is such that it rules out all competing explanations to the tested theory, can it be stated with some confidence that the data does provide confirmatory evidence for the tested theory.

DIFFICULTIES WITH POPPER'S FALSIFICATIONISM

At the logical level, Popper's falsificationist approach has encountered some difficulties. For example, the assumption that a falsifying observation will persist is itself an inductive assumption, based on experience that the same events or observations have persisted in the past and, hence, will persist in the future (see Salmon [1966, pp. 21-27] and Quinton [1967, p. 399]).

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[2] This point does not detract from the importance of McKee et al.'s [1984] results. Indeed, given the logical weakness of confirmationism, the doubt that McKee et al. [1984] throw on Watts and Zimmerman's [1978] own confirmatory results, and their own failure to confirm Watts and Zimmerman's [1978] theory using an alternative data set, casts serious doubts on the correctness of Watts and Zimmerman's theory.

If these logical difficulties are ignored because there is no answer to this problem of induction, it can be asked whether Popper's criteria constitute either a satisfactory set of ideal criteria for theory assessment and/or an accurate description of the selection process by which scientific theories are adopted in practice. Popper held that ideal criteria for scientific-theory assessment could be established by fiat or convention, that is, without reference to the way in which science is actually practiced. His concern was with normative rules, as Christenson [1983, p. 8] notes. This concern meant that Popper did not require his *a priori* rules to adequately or correctly describe the way in which scientific practice actually proceeds. However, as Lakatos [1978, pp. 123-138] discusses, it is problematic to establish the suitability or superiority of a set of normative criteria. Indeed, since Popper, the divorce of normative and historical (descriptive) accounts of theory appraisal has been rejected by leading philosophers of science, such as Kuhn, Feyerabend, Lakatos, and Laudan. Lakatos [1971, p. 91] states, "philosophy of science without history of science is empty; history of science without philosophy of science is blind." It, therefore, seems appropriate to question whether Popper's method is a descriptively valid account of the way that research proceeds in science.

HISTORY "FALSIFIES" FALSIFICATIONISM

Lakatos [1978, p. 127] states, "*Logic der Forschung* (Popper's *Logic of Scientific Discovery* [1959]), on the whole, is dryly abstract and highly ahistorical." Lakatos [1978, p. 127] continues, "Where Popper does venture to remark casually on the falsifiability of major scientific theories, he either plunges into some logical blunder, or distorts history to fit his rationality theory." When account is properly taken of scientific history, it emerges that "history falsifies falsificationism" [Lakatos, 1978, p. 123]. Kuhn's [1970] famous work is an historical/sociological investigation of the way science and scientists proceed, and it clearly demonstrates that Popper's falsificationism bears no relation to the way things "really happen" in science. "No process yet disclosed by the historical study of scientific development at all resembles the methodological stereotype of falsification..." [Kuhn, 1970, p. 77].

There are no scientific theories from which all anomalies or falsifying observations have been eliminated. Feyerabend [1978, pp. 69-161] analyzes in great detail the work of Galileo, "...who was faced by an embarrassing amount of *prima facie* refuting instances, who was unable to explain them for he lacked the necessary knowledge..." (p. 159). Copernicus' theory, which Galileo resurrected and extended to eventually replace the Ptolemaic system, was riddled with inconsistencies and refuting observations. Newtonian theory was beset by counterinstances [Kuhn, 1970, pp. 77-91; Feyerabend, 1978, pp. 59-63; and Lakatos, 1978, p. 70]. Bohr's atomic theory was introduced and retained in the face of precise and unshakable contrary evidence [Feyerabend, 1978, p. 56 and Lakatos, 1978, pp. 55-58].

Therefore, it does not seem reasonable to base a large part of the criticism of the positive theory on the fact that there are some instances (or firms) that are inconsistent with it (see Watts and Zimmerman [1978, p. 125] for a detailed list that indicates those firms which voted on the Financial Accounting Standards Board's Discussion Memorandum on General Price Level Adjustments in the opposite direction to that predicted by their theory). Indeed, as Christenson [1983, p. 8] points out "From a strictly logical point of view, a proposition is falsified not by experience but only by the acceptance of another proposition with which it is logically inconsistent." From this perspective it appears there are presently no well-articulated complete theories regarding accounting method preferences and/or choices besides the positive theory of the Rochester School.

THE DUHEM PROBLEM

In Popper's infrequent references to the history of science, he turned anomalies, or refuting observations, into "crucial experiments" and then exaggerated their immediate impact on the history of science [Lakatos, 1978, p. 127]. Great scientists have almost never accepted refutations as being decisive, because of important problems and reservations which so frequently *in reality* accompany a refuting instance. Feyerabend, Kuhn, and Lakatos illustrate amply that a "refuting" observation may disagree with a theory for a variety of reasons and hence, in practice, a "refuting" observation does not necessarily "logically" refute a theory.

A major problem in considering a refuting observation is that a theory consists of a *complex* of refutable universal statements, rather than a *single* refutable statement like, "All crows are black." Furthermore, to permit testing, more statements than those of the tested theory are involved—the theory must be augmented by auxiliary assumptions, such as laws and theories governing measurement and the use of instruments. Initial conditions, such as description of the experimental set-up, must also be added. If a prediction that follows from these joint premises turns out to be false, then all that can be logically concluded is that at least one of the premises is false and, hence, no individual hypothesis or theory is conclusively falsifiable. This problem of the jointness of testing, is referred to as the Duhem problem (see Duhem [1954]).

In accounting research, for example, market efficiency research has generated many anomalies (see Foster [1984]; Lev and Ohlson [1982]; and Ricks [1982]), but researchers in the area have not viewed the efficient markets hypothesis as falsified, because of, *inter alia*, the impossibility of locating the source of the "falsification" within the maze of premises which is effectively tested by a capital market efficiency test [Hines, 1986a]. A capital market efficiency test jointly tests premises concerning data quality; assumptions relating to transaction cost estimation; whether information is good/bad; the timing of events and information release; a specific asset pricing model; measurement theories, instruments and procedures, and so on. Indeed, Foster [1984, p. 169] and Lev and Ohlson [1982, p. 274] prefer to call efficient markets hypothesis counter-observations "research puzzles" and "surprise results" respectively, rather than "anomalies" or "falsifications."

CONCLUDING COMMENTS

The various methodologies developed by philosophers of science are relevant to accounting and finance research as organizing, heuristic, and analytical frameworks. However, to believe that there is a single "ideal" methodology, and/or to finally judge theories against such a methodology, is ill-advised. If the dangers of scientism can be appreciated by researchers early in the methodological debate within accounting and finance literature, then research may perhaps be saved from the dogmatism and many diversions of resources that have resulted in other fields of inquiry and from an unwarranted reverence for science and "the scientific method" (see Berger [1966, p. 24]; Burrell and Morgan [1979]; Mackenzie [1977]; McHugh [1971]; and Schuster [1984]). For example, Mackenzie [1977] argues that behaviorism failed largely because it was a research program devoted to the pursuit of "objective" methods, to the exclusion of consideration of the fundamental ontological status or nature of behavior, namely its dependency upon mental (i.e., internal and, hence, not readily observable) processes. Similar criticisms have been made of research programs in sociology such as the Berger and Kellner [1981] critique of the "cult of quantification" in sociological research: "a position that any sociological propositions that cannot be couched in mathematical terms are 'soft,' unscientific, and useless" (p. 126).

Indeed, Mintzberg [1979] and Zeff [1983, 1986] suggest that accounting research may already be constrained by a repression of criticalness and creativity, caused by a commitment to using rigorous statistical procedures that are incorrectly perceived by accounting researchers to be "the scientific method." This may be one reason why, despite calls by accounting researchers for the development of alternative theoretical perspectives on accounting which would require alternative methods (see Burchell et al. [1980]; Cooper and Sherer [1984]; Chua [1986]; Hines [1986a, 1986b, 1988]; Hopwood [1983]; Mintzberg [1979]; Nord [1986]; Tomkins and Groves [1983]; and Zeff [1983]), there appears to be little research presently proceeding on the development of alternative theories to positive theory.

In concluding, this Note is not intended to suggest that there are no criteria against which positive theories can be evaluated. The author believes that Christenson's [1983] criticisms of Watts and Zimmerman's theories remain valid without reliance on Popper because standards of rigor and good experimental design are sufficient to support that Watts and Zimmerman should have: (i) avoided the use of crude proxies such as the use of firm size to operationalize the concept of "political costs"; (ii) avoided the use of unrealistic assumptions in their explanatory theorizing; (iii) investigated their anomalies; (iv) clarified whether their theories were universal or probabilistic, and if the latter, explained on what conceptual grounds they should be held to be so; (v) if probabilistic, they should have stated the proportion of anomalous observations which would be consistent with their theories, and hence the proportion beyond which counterobservations would threaten their theories with disconfirmation, and (vi) rigorously tested their theories against competing hypotheses rather than merely presented data that were (partially) consistent with them.

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Auditor Changes: A Joint Test of Theories Relating to Agency Costs and Auditor Differentiation

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ABSTRACT: This study tests whether there is a positive association between a firm's agency costs and its demand for a quality-differentiated audit. Audit firm quality is represented in two ways: a continuous size model in which a direct association is posited between auditor size (measured by clients' sales) and audit quality, and a "brand name" model in which the Big Eight group of auditors is defined as higher quality suppliers. The tests are supportive of the brand name model of audit quality: agency cost proxies are significant as a group, after controlling for client size and growth, only in the brand name model. The results are also supportive (albeit weakly in some instances) of the following individual agency-related incentives for higher quality audits: monitoring of incentive performance contracts, diffusion of ownership, owner-debtholder conflict, and the subsequent issue of public securities after the auditor change. However, the explanatory power of the models tested is low, after controlling for client size and growth.

THIS paper tests whether the demand for quality-differentiated audits is, in part, associated with variables that proxy for the firm's agency costs (after controlling for client size and growth). Auditing is widely viewed as a means of reducing agency costs [Jensen and Meckling, 1976; Ng, 1978; Simunic and Stein, 1987; Watts, 1977; and Watts and Zimmerman, 1983]. It follows that when agency costs are greater there is increased demand for higher-level audit quality.

To test the hypothesis that higher-quality audits are demanded as a function of increasing agency costs, a sample of firms is selected that changed auditors. The framework adopted for testing can be described as follows: given that a change in auditor has occurred, is the choice of the new auditor associated with the firm's agency costs? Audit quality is measured in each of two different ways to correspond to the two general theories of audit quality: (1) a continuous auditor size metric based on combined sales of all public companies audited (a proxy for client-specific quasi-rents) and (2) an ordinal categorical variable representing either the brand name Big Eight or non-Big Eight accounting firms. Two repre-

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sentations of agency costs are tested: (1) the "level" of agency cost proxies in the year preceding the auditor change and (2) the "change" in the level of agency cost proxies over the three-year period prior to auditor change. The agency cost proxies tested are (1) managerial stock ownership, (2) presence of accounting-based bonus plans, (3) largest individual percentage of stock ownership (diffusion of ownership), and (4) ratio of long-term debt to total assets (leverage). An agency cost-related variable, the future issuance of public securities, is also tested.

This study constitutes a joint test of audit quality differentiation and the demand for higher-quality audits as a function of agency costs. If an association exists, it may be evidence of an agency-driven demand for higher-quality audits as well as evidence that the proxies used in the study represent differentiated audit quality. However, in any empirical study, there is the possibility that variables may proxy for something other than the underlying construct being assumed in the test. Of particular concern with respect to auditor changes is the possible confounding effects of client size and growth on the choice of the new auditor. Simply put, larger or growing companies may require a larger audit firm if the auditor is to be technically *capable* to conduct the audit. In most prior related research, client size and/or growth is significant in explaining auditor choice. Thus, in order to control for the possible confounding effects of client size or growth, these variables are included in the empirical models and tested.

The remainder of the paper is organized as follows. The next section summarizes the audit quality literature and the two models of audit firm quality differentiation. Agency cost proxies are defined in the following section and related empirical research is reviewed. The research design and sample are described next followed by a discussion of the results. The final section summarizes the study and its principal conclusions.

TWO THEORIES OF AUDIT FIRM QUALITY DIFFERENTIATION

DeAngelo [1981] defines audit quality as the joint probability of detecting and reporting material financial statement errors and concludes that larger audit firms have incentives to supply a higher level of audit quality. The argument relies on the assumption that client-specific quasi-rents, the cost advantages of incumbency due to auditor startup and client switching costs, accrue to incumbent auditors. Since larger audit firms have more clients, they have more aggregate client-specific quasi-rents at stake if a lack of independence or a low-quality audit becomes known. It is assumed that an audit firm will lose clients if such a breach occurs. DeAngelo argues that these quasi-rents serve as "collateral" or a "bond" on independence and audit quality, and that, *ceteris paribus*, auditor size is a surrogate for unobservable audit quality.[1]

Taken literally, DeAngelo's argument suggests that a cardinal ordering of auditor size can be used to proxy for audit quality. We adopt such a metric as one representation of audit quality. Specifically, an auditor size metric is developed based on the combined sales of publicly-listed companies audited by an auditor in the year of auditor change as indicated in *Who Audits America*. Companies listed in *Who Audits America* approximate the population of SEC registrants and, thus, serve as a proxy for the aggregate client-specific quasi-rents of public companies for each audit firm.

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[1] DeAngelo [1981, fn. 9, p. 186] argues that audit quality is costly to directly observe (though not unobservable in the limit), and for this reason there are incentives to find less costly surrogates of audit quality.

In DeAngelo's formulation, differential audit quality is a passive by-product of client-specific quasi-rents. This contrasts with the brand name (reputation) investment model of Klein et al. [1978] and Klein and Leffler [1981] in which firms are explicitly motivated to develop and maintain brand name reputations for quality in order to secure and protect quasi-rents arising from the brand name. In other words, the brand-name development comes first and this in turn leads to a quality-assuring price that is higher than the minimum-quality price. There is a disincentive to shirk on delivering the higher-quality product because of the potential loss of brand name (i.e., loss of the present value of future quasi-rents).[2] Klein and Leffler [1981, p. 634] conclude "Our analysis implies that consumers can successfully use price as an indicator of quality."

In the auditing industry the Big Eight firms appear to be brand name producers in the U.S. audit market.[3] Support for this can be found in the popular financial press [Stevens, 1981], in Congressional hearings [U.S. Senate, 1977], in AICPA-sponsored studies [AICPA, 1978 and 1980], and in the scholarly literature [Dopuch and Simunic, 1980 and 1982; Libby, 1979; Palmrose, 1988; Shockley, 1981; and Simunic and Stein, 1987]. There is also evidence that the Big Eight firms command price premiums [Francis and Simon, 1987; Palmrose, 1986; Rubin, 1988; Simon and Francis, 1988; for the Australian market see Francis, 1984; and Francis and Stokes, 1986]. Simon and Francis [1988] report that Big Eight fees have been consistently estimated at 16 percent to 19 percent higher than non-Big Eight audit fees across several independent studies. Big Eight price premiums are consistent with Klein and Leffler's [1981] claim that price is an indicator of quality. Further, Francis and Simon [1987] report that the Big Eight price premium holds with respect to *both* other national firms and local-regional firms and that non-Big Eight national firms do *not* command a price premium over local-regional firms.[4] Based on these studies, a two-category representation of audit quality is used with the Big Eight firms defined as brand name higher-quality suppliers.

The preceding two models can be viewed, in a sense, as competing hypotheses about audit firm quality. If audit firm size can be used to rank-order audit firm quality while holding technology constant, then agency costs should be systematically associated with changes in auditor size across the continuum of auditor size. On the other hand, if the Big Eight are brand name firms that perform higher-quality audits, then agency costs should be systematically associated with changes to or from the Big Eight group of firms. Tests are designed to determine if either (or both) of these hypotheses is supported by the data.

AGENCY COSTS AND THE DEMAND FOR HIGHER QUALITY AUDITS

Agency theory posits an inherent moral hazard problem in principal-agent (owner-manager) relations that gives rise to agency costs. While audited financial statements are widely viewed as a means of mitigating agency costs, the arguments linking auditing with reduced agency costs are informal and rely on the fact that auditing has survived in a competitive setting and presumably is cost-effective [Dopuch and Simunic, 1982; and Dopuch, 1984]. Jensen and Meckling [1976] identify two classes of agency conflict, owner-manager and owner-debtholder, and these two classes are the basis for the agency cost proxies used in the study.

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[2] DeAngelo [1981, p. 193] points out that in both the brand name model and her model of client-specific quasi-rents that the collateral is auditor-specific. The brand name model, however, substitutes *non-client-specific* collateral (investments in the brand name) for the *client-specific* collateral in her model.

[3] The Big Eight are: Arthur Andersen, Arthur Young, Coopers & Lybrand, Deloitte Haskins and Sells, Ernst and Whinney, Peat Marwick Main, Price Waterhouse, and Touche Ross.

[4] Francis and Simon [1987] restrict their analysis to the small public company market segment which mitigates against the Big Eight premium being confounded by auditor technology differences across market segments.

Owner-Manager Conflict

If there are no debt contracts, the agency problem reduces to the moral hazard between managers and owners.[5] Jensen and Meckling [1976] argue that this basic agency problem can be mitigated by making managers owners of the firm. Since owner-managers have an opportunity for entrepreneurial gains, they have incentives to increase the value of the firm rather than shirk. In the absence of manager ownership, the moral hazard problem leads owners to discount the value of their initial investments and lower management compensation. Managers then have an incentive to choose a higher-quality audit as a means of increasing their compensation. It follows from this argument that firms with higher levels of manager ownership would have less need for higher-quality audits than would firms with lower levels of manager ownership assuming a "convergence of interests" as manager ownership increases.

More recently, Demsetz [1983] and Fama and Jensen [1983a, 1983b] point out that high levels of manager ownership can lead to management "entrenchment" because control challenges are difficult to mount by nonmanager stockholders. Following this line of reasoning, Morck et al. [1986] hypothesize a nonlinear relation between manager ownership and corporate performance. Their results show that firms with 5 to 20 percent manager ownership perform better than firms *either* below 5 percent or greater than 20 percent. Thus, manager ownership is tested both as a continuous variable and as a nonlinear variable coded one if outside the 5 to 20 percent range and zero if in the 5 to 20 percent range. Data on manager ownership is found in the firm's annual proxy statement and represents the proportion of issued stock owned by officers and directors of the firm.

Another means of reducing agency costs is the use of incentive performance contracts for managers. While incentive contracting may improve managerial performance compared with pure wage contracts, the use of incentive compensation contracts also results in additional monitoring costs. Watts and Zimmerman [1983, pp. 614–615] state "Corporate managers or promoters write contracts (by-laws, charters, indenture agreements, compensation plans) that reduce their opportunism. Enforcement of the contract requires monitoring of management's activities and it is hypothesized by Jensen and Meckling that this is a role of auditing." In other words, the creation of an additional contract that relies on accounting-based performance measurement creates a demand for more or higher-quality monitoring. Firms having incentive performance plans are hypothesized to be more likely to use a higher-quality auditor than firms without such plans. The existence of accounting-based incentive performance (bonus) contracts is reported in the firm's annual proxy statement.

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[5] Jensen and Meckling [1976] argue that divergent interests and inability of the principal to directly observe the agent's actions lead directly to a "moral hazard" or inherent conflict of interests between principals and agents. Agency costs can be offset to some extent by writing contract provisions for bonding and monitoring to guarantee that the agent will act in the principal's interest. The sum of bonding, monitoring, and residual costs of agent's actions are collectively referred to as agency costs.

A third variable affecting the extent of owner-manager conflict is diffusion of ownership. Alchian and Demsetz [1972, p. 788] argue that the operative aspect of diffusion is its effect on the probability that management will be removed. Greater diffusion of ownership increases the cost and effort required to obtain proxy transfers necessary to affect management policy and, in particular, to force a change in management. Thus, owner constraints on management actions are inversely proportional to the degree of diffusion. Fama and Jensen [1983a, 1983b] contend that large organizations with diffuse ownership resolve the agency cost problem by separating internal decision management and control. Hierarchical separation of decision management and control reduces the ability of individual agents to expropriate residual claimants' wealth. Empirical tests of Demsetz and Lehn [1985] are supportive of Fama and Jensen's argument because no difference in corporate performance is found as a function of ownership diffusion.

These arguments suggest that a higher-quality audit can be considered as part of the complex control system that mitigates the relative inability of diffused ownership to directly monitor and control management action. Diffusion is measured as the percentage of common stock owned by the largest single shareholder as reported in proxy statements. A ten percent reporting threshold exists for pre-1982 proxy disclosures. Thus, the variable is coded one if the largest individual owner has ten percent or more of outstanding stock, and zero if the largest individual holding is less than ten percent. Dhaliwal et al. [1982] and Palmrose [1984] use the same coding rule. The hypothesis is that firms with more diffuse ownership are more likely to use a higher-quality auditor.

Owner-Debtholder Conflict

Agency theory posits that debtholders are concerned about possible wealth transfers to stockholders [Smith and Warner, 1979]. Managers favor the interests of stockholders to the detriment of debtholders and, for this reason, restrictive covenants are written into debt contracts. Thus, it has been hypothesized [Eichenseher and Shields, 1986; Palmrose, 1984; and Simunic and Stein, 1987] that the presence of long-term debt contracts creates a demand for higher-quality audits. However, Healy and Lys [1986] and Johnson and Lys [1986] draw a distinction between *existing* debtholders at the time of an auditor change, and incentives with respect to *future* debt issues after an auditor change. If a firm switches to a lower-quality auditor, the value of existing debt claims is expected to drop, thus, increasing the value of stockholders' residual claims. Based on this reasoning, it is hypothesized that firms with higher debt levels are more likely to switch to a lower-quality auditor. The ratio of long-term debt (excluding deferred credits) to total assets is used to proxy for debt. The effect of *future* debt issues after an auditor change is treated as a separate variable as discussed below.

Firms may change auditors (especially from a non-Big Eight firm to a brand name Big Eight firm) to increase the marketability of the new securities [Carpenter and Strawser, 1971]. Thus, issuance of new securities could be either an incentive to change auditors or an indication of the nature of the change itself.

A variable is used indicating the firm's publicly issued new stock or debt within two fiscal years after the year of auditor change. An auditor change is argued to have signalling value regarding the firm and information about the firm *vis-a-vis* accounting data [Titman and Trueman, 1986]. While this argument relates to signalling and asymmetric information, the underlying condition that gives rise to it is a principal-agent problem in which there is asymmetric information between the owner (or would-be owner) and the agent. Johnson and Lys [1986] also point out that *existing* stockholders at the time of an auditor change "capture" the benefits of this reduced information risk *vis-a-vis subsequent* stock or debt issues, thus creating the incentive for switching to a higher-quality auditor.

Related Empirical Research

Several studies have investigated the association of agency cost proxies and auditor choice. Results of these five studies with respect to the specific variables tested here are as follows.

Managerial Ownership. Manager stock ownership was tested in Eichenseher and Shields [1986] and was significant but positively associated with the change to a Big Eight auditor, contrary to predictions. Simunic and Stein [1987], on the other hand, found that lower levels of manager ownership were associated with the choice of a Big Eight auditor in initial public offerings as predicted.

Bonus Plans. The presence of accounting-based plans was only tested in Palmrose [1984] and was not significant.

Diffusion of Ownership. Diffusion of ownership was only tested by Palmrose [1984] and was not significant.

Leverage. Leverage was hypothesized to be positively associated with the choice of a Big Eight auditor by Palmrose [1984], Eichenseher and Shields [1986], and Simunic and Stein [1987], and negatively associated with Big Eight audit firms whose clients underwent mergers [Healy and Lys, 1986] and larger firms changing auditors [Johnson and Lys, 1986]. A positive association was reported by Eichenseher and Shields [1986], a negative association found by Simunic and Stein [1987], with insignificant results were reported by Palmrose [1984], Healy and Lys [1986], and Johnson and Lys [1986].

New Issues. New debt/stock, post auditor change, was tested by Healy and Lys [1986] and was not significant. Johnson and Lys [1986] report a positive and significant association with the choice of a larger auditor.

In sum, the research in this area exhibits a wide range of designs. At best, only a very weak association has been demonstrated to exist between agency cost proxies and audit firm choice with little interstudy consistency.

RESEARCH DESIGN

While agency costs alone may sometimes lead to the decision to change auditors, the evidence suggests that auditor changes are frequently motivated by other factors [Carpenter and Strawser, 1971; Bedingfield and Loeb 1974; and Eichenseher and Shields, 1983].[6] Thus, the auditor change decision is characterized as a two-step process: first, a decision is made to change auditors (which may or may not be motivated by agency costs) and, second, a new auditor is chosen. If agency costs influence *both* the decision to change as well as the choice of a new auditor, then "changes" in agency costs preceding the auditor change should be associated with the new auditor size. However, even if "changes" in agency costs are insufficient, in themselves, to motivate a costly auditor switch, it is still possible that the existing "levels" of agency costs could be an important factor in the choice of the new auditor, given that a decision to change has been made for other reasons. Agency costs are, thus, tested as both "changes" and "levels" in the models to be estimated.

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[6] Some reasons identified for voluntary auditor changes include: (1) change in top management, (2) corporate mergers, (3) need for additional services, (4) dissatisfaction with old auditor, (5) ability to raise new capital, (6) disputes over accounting principles, (7) regular rotation policy, (8) audit partner switched to another accounting firm, (9) retirement of audit partner, and (10) audit fee disputes.

Since client size and/or growth is significantly associated with auditor choice in other studies [Healy and Lys, 1986; Johnson and Lys, 1986; Palmrose, 1984; and Simunic and Stein, 1987], it is incorporated here as a covariate. Client size, measured by total assets the year prior to change, is included in the "levels" model and growth, measured as the percentage change in client size over the three years prior to auditor change, is included in the "changes" model. Two additional tests are conducted to determine the effect of client size and/or growth on the results. First, a Chow test is used to determine if the empirical models are consistent across the upper/lower halves of the samples partitioned by median client size or growth as appropriate. Second, the explanatory power of the models is evaluated *with* and *without* client size/growth in order to assess the marginal contribution of the agency variables over and above client size/growth variables.

A final point concerns the meaning of client size and growth with respect to auditor choice. Fama and Jensen [1983a, 1983b] argue that, in general, as firm size increases so does its agency costs. From this perspective, client size/growth could be argued to proxy (albeit indirectly) for agency costs in which case a positive association would exist between client size or growth and the demand for audit quality. Alternatively, Johnson and Lys [1986, p. 10] argue that fixed investments in the auditor's error-detection technology leads to specialization in market segments and the "differences in technologies and cost functions across market segments are likely to be reflected by differences in audit firm size, with each segment dominated by audit firms of approximately the same size." In the Johnson and Lys framework, client size or growth is likely to be associated with larger sized auditors primarily due to technology or audit efficiency rather than agency costs. We make no attempt to interpret what client size and growth may mean with respect to auditor changes. Instead, we estimate the effect of the more specific agency proxies after controlling for client size and growth. This approach implicitly assumes that there is no relation between client size/growth and agency costs.

Specification of the Model

To test the hypothesized relation between audit firm choice and agency costs, three model specifications are used: a pre-change *levels* of agency cost model, a *changes* in agency cost model, and, for completeness, a composite model of both *levels* and *changes* in agency cost variables. Each of the three model specifications is estimated using two alternative measures of audit firm quality. The first is a dichotomous measure based on the Big Eight and non-Big Eight categories. An "upgrade" in quality from a non-Big Eight to a Big Eight audit firm is assigned a value of one and a "downgrade" is assigned a value of zero. The second measure is a continuous size measure defined as the natural logarithm of the ratio of total dollar sales audited by the new auditor to that of the old auditor at the time of the auditor change.[7] Table 1 defines all variables and the predicted direction of association with audit firm size.

Since a dichotomous dependent variable violates OLS regression assumptions, probit is used to estimate the "brand name" models using the categorical Big Eight vs. non-Big Eight dependent variable.[8,9] OLS regression is used for the continuous size models.

Sample Selection and Data Sources

Auditor changes were identified using the 4th to 13th editions of *Who Audits America* [Data Financial Press, 1979–1985]. The sample included auditor changes occurring from June 1978 through April 1985. A total of 3,264 auditor changes were listed. From this total, 676 auditor changes were selected which represented companies for which data were available for the year of the auditor change from both COMPUSTAT and *Q-DATA* microfiche (proxy statements and 10-K annual reports). However, prior years' data needed to compute changes in agency costs were missing in many cases and many of the companies were not publicly traded three years prior to the auditor change. In addition, the client sales audited data were missing for many of the audit firms, particularly in the earlier volumes of *Who Audits America.* Since the COMPUSTAT sample tends to be biased toward larger companies that are more likely to change to or from another Big Eight audit firm, 129 smaller, non-COMPUSTAT companies that changed from a non-Big Eight to another non-Big Eight firm were added to the sample. Financial data for these firms were obtained from *Q-DATA* annual reports and the *Moody's Industrial Manual* or *Moody's Over The Counter Manual.* The final sample, after deleting the companies with missing data, consisted of 196 companies.[10,11] Of these 196 com-

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[7] Since ratios close to one might suggest little preference for a different size auditor, the models were also estimated on a reduced sample in which the middle one third of the distribution was excluded. However, since the results were similar to the full model, only the full model results are reported.

[8] The probit procedure relies on maximum likelihood estimators rather than ordinary least squares estimators. The sampling properties of maximum likelihood estimators are described by McKelvey and Zavoina [1975]. Under fairly general conditions, the MLE's are asymptotically normally distributed and are consistent and efficient. Hypotheses on individual variables can, thus, be tested using a Chi-square statistic with one degree of freedom. Alternatively, the significance of individual coefficients can be tested by using a test statistic defined as the ratio of the maximum likelihood estimate to its standard error. This statistic is asymptotically distributed as a t-statistic with $n-k$ degrees of freedom where n is the number of observations and k is the number of parameters being tested.

[9] Logit and OLS were also used to test whether the results were sensitive to the statistical procedure used. The significance levels and signs of all coefficients were very similar to the probit results. Probit was used since the procedure specifically utilizes the ordinality of the dependent variable and it is not clear that this is the case for logit when the dependent variable is dichotomous.

[10] To ensure that the change was not due to an audit firm merger or liquidation, we checked *Who Audits America* to determine whether the old auditor continued to exist under the same name for two years following each auditor change. No changes due to auditor merger were detected. However, six changes were associated with one audit firm that liquidated. Of these changes, two involved a change to a Big Eight firm and four to another regional or national firm. All models were run with these changes deleted and the results are not materially affected by the inclusion of these changes. Although there may have been some instances of client mergers, that would not mean that a related auditor change was involuntary. That is, the decision to change auditors in light of a corporate merger is still a voluntary auditor change.

[11] Four firms reflecting nonrepresentative asset growth (in two cases greater than 1100 percent) over the three years preceding the change were eliminated from the sample as the skewness of the distribution for this sample was clearly distorting the association between GROWTH and choice of auditor. The large asset growth for the firms discarded were not due to data errors; they were simply very small firms that experienced extraordinary growth. Logarithmic or other transformation was not considered appropriate given the extreme skewness and the fact that negative change values also occur. Results for the agency variables were not substantially different, however, whether the full sample of 200 firms was used or the 196-firm final sample for which the results are reported.

TABLE 1

DESCRIPTION OF VARIABLES

Variable Name	*Expected Sign*	*Description*
Dependent:		
Brand Name Model		Dependent variable based on either a change from a non-Big Eight to a Big Eight audit firm (=1) or from a Big Eight to a non-Big Eight audit firm (=0).
Continuous Size Model		Dependent variable defined as the natural logarithm of the ratio of combined sales of public companies audited by the new auditor to that by the old auditor in the year of the auditor change as reported in *Who Audits America*.
Independent:		
MGRSK	+	Indicator variable indicating the amount of a company's outstanding common stock owned by management (officers and directors) the year preceding auditor change (0=five to 20 percent, 1=less than five percent or greater than 20 percent).
MGRSKCHG	+	Change in MGRSK for the three years prior to auditor change. If manager stock ownership was in the range of five to 20 percent in year preceding auditor change but outside this range three years prior, MGRSKCHG was coded "1," if the opposite was the case a "−1" was assigned, and if there was no change in status, a "0" was assigned.
BONUS	+	Indicator variable indicating the existence of an accounting-based incentive bonus plan for top executives in year preceding auditor change (0=no, 1=yes).
BONUSCHG	+	A three-level variable indicating whether a bonus plan was implemented during the three years preceding the auditor change (1=yes), there was no change in the existence of the bonus plan during the preceding three years (=0), or a bonus plan was terminated during the preceding three years (=−1).
LGOWN	−	Diffusion of ownership, proxied for by the percentage of outstanding shares owned by the largest single shareholder. (1 if greater than ten percent, 0 if less.)
LGOWNCHG	−	A three-level variable indicating change in LGOWN prior to the auditor change. If largest ownership four years prior to change was less than ten percent but was more than ten percent the year prior to change, LGOWNCHG was coded "1," if the opposite was the case it was coded "−1," and if there was no change it was coded "0."
LTDBT	−	Ratio of long-term debt (excluding deferred income taxes) to total assets for the year preceding the auditor change.
LTDBTCHG	−	The ratio of long-term debt to assets for year preceding the auditor change minus the same ratio three years earlier.

TABLE 1—*Continued*

Variable Name	*Expected Sign*	*Description*
NEWISSUE	+	Total dollar amount of publicly issued stock and debt for two fiscal years after year of new auditor's initial engagement, deflated by total assets in year preceding auditor change.
SIZE	+	Natural logarithm of total assets at end of the year preceding auditor change.
GROWTH	+	Total assets year preceding the auditor change minus total assets three years earlier deflated by total assets three years earlier, expressed as a percentage change, where total assets are in raw (not logarithmic) form.

panies, 194 were used in the "continuous size" OLS models. Since only the upgrades and downgrades were used in the "brand name" probit models, 118 same-size group changes (i.e., Big Eight to Big Eight or non-Big Eight to non-Big Eight) were excluded leaving 78 firms for testing, 57 upgrades, and 21 downgrades. Details of the sample are summarized in Table 2.

RESULTS

Table 3 reports descriptive statistics for all variables for the "brand name" sample of 78 auditor changes. These descriptive statistics are comparable to those for the "continuous size" sample. Therefore, descriptive statistics for the continuous size model are not reported. LGOWN and LTDBTCHG have opposite than expected associations with auditor changes. Otherwise, the differences in means for upgrades vs. downgrades are in the predicted directions.

The "brand name" probit estimates are reported in Table 4 for the three model specifications. Table 5 reports the same three model specifications for the "continuous size" OLS estimations. Spearman bivariate correlations among independent variables are reported in Table 6 for the "continuous size" sample. These are similar to those for the "brand name" sample which are not reported.

The brand name model (Table 4) is not significant when using "levels" of agency variables; however, both the "changes" in agency variables model and the composite variables model are significant at the .05 level. Since the "levels" model is not significant, it will not be discussed further. The composite model has slightly greater explanatory power than the "changes" model as indicated by the probit (psuedo) R-square and classification accuracy; however, an incremental Chi-square test indicated that the "levels" variables were not significant (as a group) when added to the "changes" variables.[12] In the "changes"

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[12] McKelvey and Zavoina [1975] describe the probit estimated R-square as an indication of how well the data fit the presumed underlying theoretical distribution. This measure should not be interpreted in the conventional manner since OLS regressions indicated R-squares ranging from about .03 for the "levels" model to .11 for the "changes" model, though the coefficient significance levels and overall model significance were very similar to the probit results. Considering the probable poor fit in the OLS models due to violation of underlying regression assumptions, the actual goodness of fit is probably somewhere between the OLS and probit estimates.

TABLE 2
DESCRIPTION OF SAMPLE SELECTION

Panel A: Sample Selection Procedures	
Total auditor changes listed in *Who Audits America* (June 1978 through June 1985)	3,264
Auditor changes for which COMPUSTAT data, proxy statements, and 10-K reports were available for year of change.	676
Added 129 non-Big Eight to non-Big Eight changes for which *Q-DATA* annual reports and *Moody's Industrial Manual* (or other Moody's manuals, as appropriate) were available, but not COMPUSTAT.	129
Total preliminary sample	805
Eliminated due to missing data for three years preceding auditor change and data on total dollar sales audited.	609
Final sample	196*
Panel B: Classification of Auditor Changes	
Non-Big Eight auditor to Big Eight auditor	57
Big Eight auditor to non-Big Eight auditor	21
Changed to same-size auditor group	118
Total	196*

* For two of these 196 audit firms no details were available in *Who Audits America* to calculate total dollar sales audited which resulted in a sample of 194 for the "continuous size" sample. However, these two observations are included in the "brand name" sample.

model BONUSCHG, LGOWNCHG, and GROWTH are individually significant at the .05 level, and NEWISSUE is nearly significant at the .10 level. In the composite model BONUSCHG, LGOWNCHG, LTDBT, LTDBTCHG, SIZE, and GROWTH are all significant at the .10 level or less, and NEWISSUE is nearly significant. Of the significant variables only LTDBTCHG has an unexpected sign, and, overall, three of the agency cost proxies are significant in the predicted direction.

The continuous size model (Table 5) broadly parallels the brand name model. Using "levels" of agency variables the model is not significant, but the "changes" in agency variables model and the composite variables model are both significant at the .10 level. The individually significant variables are two agency proxies, BONUSCHG and NEWISSUE, along with GROWTH. There is little difference in explanatory power between the "changes" and composite models, thus, it appears that the composite model is driven entirely by the "changes" in agency variables. An incremental *F*-test for the "levels" variables was not significant when they were added as a group to the "changes" variables.

Collinearity is not a serious problem among the independent variables. Table 6 indicates that among the "level" variables, bivariate Spearman correlations

TABLE 3

DESCRIPTIVE STATISTICS FOR "BRAND NAME" SAMPLE (1978–1985)
("LEVELS" OF VARIABLES FOR YEAR PRECEDING AUDITOR CHANGE AND "CHANGES" IN VARIABLES OVER THREE YEARS PRECEDING AUDITOR CHANGE)

	Full Sample (*N*=78)				*Non-Big Eight to Big Eight* (*N*=57)				*Big Eight to Non-Big Eight* (*N*=21)			
*Variables**	*Mean*	*S.D.*	*Min.*	*Max.*	*Mean*	*S.D.*	*Min.*	*Max.*	*Mean*	*S.D.*	*Min.*	*Max*
MGRSK	.744	.439	.000	1.000	.772	.423	.000	1.000	.667	.483	.000	1.00
MGRSKCHG	−.013	.470	−1.000	1.000	.035	.421	−1.000	1.000	−.143	.573	−1.000	1.00
BONUS	.423	.497	.000	1.000	.456	.503	.000	1.000	.333	.483	.000	1.00
BONUSCHG	.154	.512	−1.000	1.000	.211	.526	−1.000	1.000	.000	.447	−1.000	1.00
LGOWN	.859	.350	.000	1.000	.877	.331	.000	1.000	.810	.402	.000	1.00
LGOWNCHG	.038	.340	−1.000	1.000	.000	.327	−1.000	1.000	.143	.359	.000	1.00
LTDBT	.180	.139	.000	.530	.163	.123	.000	.432	.228	.169	.002	.53
LTDBTCHG	.000	.127	−.279	.413	.005	.126	−.279	.286	−.011	.131	−.214	.41
NEWISSUE	.071	.292	.000	2.132	.094	.339	.000	2.132	.011	.049	.000	.22
SIZE	65.219	112.640	1.523	696.824	68.567	116.345	1.523	696.824	56.132	104.058	2.208	472.93
GROWTH	66.472	90.475	−77.489	342.515	79.969	92.312	−76.188	342.515	29.836	75.672	−77.489	206.86

* Definition of variables: (See Table 1 for complete description)

MGRSK = Percentage of stock owned by managers and directors, 0 = five to 20 percent ownership; 1 = less than five percent or greater than 20 percent
MGRSKCHG = Change in stock owned by managers and directors, 1 indicates a change from outside the 5–20 percent range into the range; −1 indicates a change from within the 5–20 percent to outside the range; 0 indicates no change across ranges
BONUS = Existence of a bonus incentive compensation plan (0 = no, 1 = yes)
BONUSCHG = Change in existence of bonus plan (1 = initiation of a new plan, 0 = no change in status of bonus plan; −1 = termination of plan)
LGOWN = Percentage of stock ownership by largest single owner (1 if greater than ten percent; 0 if less than ten percent)
LGOWNCHG = Change in stock ownership by largest single owner (1 indicates a change from less than ten percent to greater than ten percent; −1 is the opposite change; 0 is no change in the ten percent value).
LTDBT = Leverage, debt divided by total assets
LTDBTCHG = Change in leverage ratio
NEWISSUE = New security issues after auditor change deflated by total assets
SIZE = Total assets (logarithmic form)
GROWTH = Percentage change in total assets

TABLE 4

PROBIT REGRESSION ESTIMATES FOR "BRAND NAME" MODELS ($N=78$)
(DEPENDENT VARIABLE IS CHANGE FROM A NON-BIG EIGHT FIRM TO A BIG EIGHT FIRM (1) OR CHANGE FROM A BIG EIGHT TO A NON—BIG EIGHT FIRM (0))

		Model One Pre-change Levels of Independent Variables		*Model Two Three-year Changes in Independent Variables*		*Model Three Composite Model*	
Variables	*Predicted Sign*	*Coefficient*	*Asymptotic t-statistics*	*Coefficient*	*Asymptotic t-statistics*	*Coefficient*	*Asymptotic t-statistics*
CONSTANT		.170	.28	.329	1.64	−.284	−.35
MGRSK	+	.304	.76			−.150	−.26
MGRSKCHG	+			.244	.65	.074	.15
BONUS	+	.313	0.89			.134	.29
BONUSCHG	+			.683	1.85**	.648	1.35*
LGOWN	−	.063	.13			.692	1.06
LGOWNCHG	−			−1.018	−1.80**	−1.166	−1.85**
LTDBT	−	−2.633	−2.13**			−3.338	−2.20**
LTDBTCHG	−			1.394	.94	2.743	1.59*
NEWISSUE	+	2.518	1.05	2.885	1.23	3.853	1.21
SIZE	+	.150	1.12			.213	1.32*
GROWTH	+			.004	1.83**	.005	2.10**
Probit psuedo R^2		.397		.517		.658	
Model Chi-Square statistic (two-tailed test)		9.59 (6 df)		15.54** (6 df)		23.02** (11 df)	
Percent Correctly Predicted:							
Overall		71.8		73.1		75.6	
Non-Big Eight to Big Eight		91.2		93.0		89.5	
Big Eight to non-Big Eight		19.0		19.0		38.1	

Note: Definition of independent variables: (See Table 1 for complete description)
MGRSK = Percentage of stock owned by managers and directors
MGRSKCHG = Change in stock owned by managers and directors
BONUS = Existence of a bonus incentive compensation plan
BONUSCHG = Change in existence of bonus plan
LGOWN = Percentage of stock ownership by largest single owner
LGOWNCHG = Change in stock ownership by largest single owner
LTDBT = Leverage, debt divided by total assets
LTDBTCHG = Change in leverage
NEWISSUE = New security issues after auditor change
SIZE = Total assets (logarithmic form)
GROWTH = Percentage change in total assets
Levels of significance (one-tailed tests):
* $p<.10$
** $p<.05$
*** $p<.01$

are no greater than $r=.30$, and among the "change" variables the correlations are no greater than $r=.19$. As might be expected, there is a larger correlation between the level of a variable and the related change in the variable.[13] For example, MGRSK and MGRSKCHG, BONUS and BONUSCHG, and LGOWN and LGOWNCHG are all fairly highly correlated ($r > .47$). However, examination of the collinearity diagnostics suggested by Belsley et al. [1980] indicates that there is no serious degradation of the regressions due to collinearity among the data and, also, that the results are not being driven by outliers, after deletion of the four firms with nonrepresentative asset growth as discussed in fn. 11.

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[13] If a firm's agency costs have changed over a three-year period, it follows *ceteris paribus* that the level of agency costs at the end of the three-year period will be correlated with the change (in a cross-section of firms).

Effects of Client Size and Growth

As discussed above, it is possible that client size and/or growth could confound the empirical tests of the agency variables. For this reason, the "levels" model in Tables 4 and 5 is tested for consistency across client size and the "changes" model in Tables 4 and 5 is tested for consistency across client growth. A Chow test [Chow, 1960] is used to determine if the model parameters are consistent across the upper/lower halves of client size and growth.[14] Median SIZE and GROWTH are used to divide the sample for testing. None of the F-statistics from the Chow tests are significant at the .10 level. Thus, one cannot reject the hypothesis that parameters are equal across client size in the "levels" model and across client growth in the "changes" model. The Chow tests provide evidence that agency-related variables are associated with auditor choice independently of client size and growth.

A further analysis determines the relative explanatory power of the agency-related variables *alone* compared with client size and growth *alone*, as well as the incremental explanatory power of the agency-related variables over and above client size and growth. The composite models in Tables 4 and 5 are used for these analyses.

Results of reestimating the probit models (Table 4) are as follows: The agency variables *alone* had a probit R-square of .595 and classification accuracy of 75.6 percent; SIZE and GROWTH *alone* had a probit R-square of .142 and an overall classification accuracy of 74.4 percent. The incremental effect of adding the agency variables was significant at the .05 level (Chi-square of 17.23, nine degrees of freedom) and the probit R-square increased from .142 to .658. The overall classification accuracy only increased from 74.4 percent to 75.6 percent, but there was a marked improvement in downgrade classification as SIZE and GROWTH alone classified only 4.8 percent of downgrades compared with 38.1 percent for the full model that included agency-related variables. That is, the incremental effect of the agency variables did not improve classification of upgrades but substantially improved the classification of downgrades.

Results of reestimating the OLS continuous size models (Table 5) are as follows: the agency variables *alone* had an adjusted R-square of .01; SIZE and GROWTH *alone* had an adjusted R-square of .036; the incremental effect of adding the agency variables was not significant even at the .10 level, and the adjusted R-square only increased from .036 to .040. In the continuous size model, then, the agency variables are not incrementally significant when added to size and growth.

In sum, these additional tests indicate that the agency-related variables *alone* explain auditor changes about the same as SIZE and GROWTH *alone*. Because of the ambiguity in interpreting client size and growth, a conservative approach is taken by assuming *no* relation

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[14] For the Chow test, the brand name model had to be estimated using OLS regression rather than probit in order to derive the standard errors required for the test.

TABLE 5

OLS REGRESSION ESTIMATES FOR "CONTINUOUS SIZE" MODELS ($N=194$)
(DEPENDENT VARIABLE IS NATURAL LOG OF THE RATIO OF DOLLAR SALES AUDITED BY NEW AUDITOR TO THAT BY THE OLD AUDITOR)

Variables	*Predicted Sign*	*Model One Pre-change Levels of Independent Variables*		*Model Two Three-year Changes in Independent Variables*		*Model Three Composite Model*	
		Coefficient	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
CONSTANT		.650	.61	.547	1.54	.375	.33
MGRSK	+	.491	.74			.224	.28
MGRSKCHG	+			.555	.94	.350	.48
BONUS	+	.520	.87			−.384	−.54
BONUSCHG	+			1.131	2.00**	1.361	1.91**
LGOWN	−	.565	.77			.879	1.03
LGOWNCHG	−			−.352	−.46	−.763	−.85
LTDBT	−	−1.268	−0.93			−1.131	−.83
LTDBTCHG	−			.018	.28	.013	.20
NEWISSUE	+	1.118	1.33*	1.104	1.33*	.932	1.11
SIZE	+	−.049	−.26			−.084	−.45
GROWTH	+			.009	2.63***	.009	2.76***
R^2 (adj.)		−.004		.045		.040	
Model F-statistic (two-tailed test)		0.89 (6,187 df)		2.52** (6,187 df)		1.73* (11,182 df)	

Note: Definition of independent variables: (See Table 1 for complete description)
MGRSK = Percentage of stock owned by managers and directors
MGRSKCHG = Change in stock owned by managers and directors
BONUS = Existence of a bonus incentive compensation plan
BONUSCHG = Change in existence of bonus plan
LGOWN = Percentage of stock ownership by largest single owner
LGOWNCHG = Change in stock ownership by largest single owner
LTDBT = Leverage, debt divided by total assets
LTDBTCHG = Change in leverage
NEWISSUE = New security issues after auditor change
SIZE = Total assets (logarithmic form)
GROWTH = Percentage change in total assets
Levels of significance (one-tailed tests)
* $p<.10$
** $p<.05$
*** $p<.01$

between client size/growth and agency costs. Using this framework, the agency variables have explanatory power (above and beyond SIZE and GROWTH) but only in the brand name model. As noted above, the agency proxies are incrementally useful primarily in classifying downgrades.

Discussion

Four matters are of primary interest: (1) comparison of the brand name versus continuous size models, (2) overall importance of the agency variables, (3) individually significant agency variables, and (4) comparison of the "levels" and "changes" variables.

TABLE 6
SPEARMAN CORRELATION COEFFICIENTS
CONTINUOUS SIZE SAMPLE (N=194)

Variables		X*1*	X*2*	X*3*	X*4*	X*5*	X*6*	X*7*	X*8*	X*9*	X*10*
MGRSK	(*X*1)										
MGRSKCHG	(*X*2)	.55*									
BONUS	(*X*3)	−.05	−.05								
BONUSCHG	(*X*4)	−.07	.07	.57*							
LGOWN	(*X*5)	.30*	.02	.01	.02						
LGOWNCHG	(*X*6)	−.00	−.05	.08	.02	.48*					
LTDBT	(*X*7)	−.12*	−.03	.11	−.01	−.16*	.08				
LTDBTCHG	(*X*8)	.06	.11	−.04	−.03	.07	.08	.37*			
NEWISSUE	(*X*9)	−.01	−.06	−.06	−.03	.02	.02	−.01	−.04		
SIZE	(*X*10)	−.14*	−.02	.18*	.15*	−.20*	.03	.29*	.00	.06	
GROWTH	(*X*11)	.04	−.02	.06	.07	.03	.01	.14*	.19*	.17*	.10

* Significant at the .10 level (two-tail)

Definition of variables: (See Table 1 for complete description)

MGRSK = Percentage of stock owned by managers and directors
MGRSKCHG = Change in stock owned by managers and directors
BONUS = Existence of a bonus incentive compensation plan
BONUSCHG = Change in existence of bonus plan
LGOWN = Percentage of stock ownership by largest single owner
LGOWNCHG = Change in stock ownership by largest single owner
LTDBT = Leverage, debt divided by total assets
LTDBTCHG = Change in leverage
NEWISSUE = New security issues after auditor change
SIZE = Total assets (logarithmic form)
GROWTH = Percentage change in total assets

Brand Name vs. Continuous Size Models. The tests consistently support the brand name model of auditor quality differentiation but not the continuous size model. While the agency variables as a group are significant in both models, they are significant after including client size/growth *only* in the brand name model. In the brand name composite model, four individual agency variables are significant at the .10 level (and NEWISSUE is nearly significant), whereas, only one agency variable is significant in the continuous size composite model. It also appears that the brand name model has substantially greater explanatory power, though a direct comparison of the brand name versus continuous size models cannot be based on *R*-square statistics since each model uses a different dependent variable.[15]

Agency Variables. The agency variables, as a group, are significant and explain about the same amount of cross-sectional variance in the models as do client size and growth by themselves. However, the agency variables as a group are incrementally significant after client size and growth, only in the brand name model. Therefore, assessment of the individual variables will be confined to the brand name model. The number of individually significant agency proxies is greater than in prior studies. Five agency-related variables in Table 4 are either significant or nearly significant at the .10 level: BONUSCHG, LGOWNCHG, LTDBT, LTDBTCHG, and NEWISSUE.[16] All of the model variables have the expected sign with the exception of LTDBTCHG. Contrary to predictions, there is a significant positive association between a change in the firm's leverage level and the demand for a Big Eight brand name auditor. Yet the level of leverage (LTDBT) at the time of the auditor change is consistent with theoretical predictions. Apart from this anomaly, the individual variables are at least weakly supportive of the individual agency arguments except for managerial stock ownership. As indicated earlier, managerial ownership is tested as both a continuous variable and as a nonlinear indicator variable based on the work of Morck et al. [1986], and there is no indication that managerial ownership (measured either way) affects the demand for a quality-differentiated auditor.

Levels vs. Changes in Agency Variables. In both the brand name and continuous size models, the specification using "levels" of agency variables is not significant while the specification using

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[15] Table 4 evidences that changes to or from brand name Big Eight auditors (upgrades/downgrades) are associated with agency cost variables. We reestimated the brand name sample of auditor changes using the continuous size measure as the dependent variable and obtained results broadly consistent with those reported in Table 4. We then deleted the "brand-name-switches" from the continuous size model to see if the continuous size model was significant for auditor changes *other than* brand-name upgrades/downgrades. The reestimated model was not significant which suggests that the results in Table 5 are dominated by the effect of brand name upgrades/downgrades. This is further evidence that the brand name model is significant and that the continuous size model is not significant.

[16] The alternative use of an indicator variable for a new issue within two years after the auditor change was consistently significant across models and the overall performance of the models was similar to those reported. In addition, a variable indicating the post-change vs. pre-change difference in issue magnitude was not significant in any model. However, one would not necessarily expect pre-change issues followed by no post-change issues to influence the choice of auditor. To further assess the effects of pre- vs. post-change issues, nonparametric tests were performed on the magnitudes of issues before and after the auditor changes. A Mann-Whitney *U*-test indicated no significant difference in pre-change issues between the lower one third and upper one third groups based on continuous auditor size. The same test for post-change issues between the two groups revealed a significant difference at the .05 level. In a second test, Wilcoxon Signed Rank tests conducted on the full sample ($N = 196$) found significant differences between pre-change and post-change issues. Thus, these univariate tests suggest that the timing and relative magnitudes of new security issues may have more influence on auditor choice than the multiple regression models indicate.

"changes" in agency variables is significant at the .05 level for both models. Consistent with this is the fact that the composite model (which includes both "levels" and "changes" in agency variables) is not significantly different from the "changes" model in either Table 4 or Table 5. In the auditor change framework set out earlier in the paper (where the decision is first made to change auditors and then the new auditor is chosen) the significant results using "changes" in agency variables is consistent with agency costs *both* motivating the auditor change *and* affecting the choice of a new auditor. However, the incremental effect of the agency variables above client size and growth is fairly small and is confined to explaining downgrades.

SUMMARY AND CONCLUSIONS

This study examined the possible linkage between agency costs and demand for quality-differentiated audits. Audit firm quality was defined as a categoric variable, the brand name Big Eight vs. non-Big Eight auditors, and as a continuous size variable based on total client sales audited by the audit firm. The tests provided support for the hypothesized association between agency cost proxies and the choice of a brand name Big Eight auditor after controlling for the effects of client size and growth; however, no consistent association was evident using the "continuous size" proxy for audit quality. The individual agency cost proxies that were at least weakly significant were the presence of accounting-based incentive bonus plans, diffusion of ownership, leverage, and new issues of securities following the auditor change.

A final *caveat* concerns the overall explanatory power of the models (including the incremental effect of agency variables). Holding aside possible measurement error problems, the results indicate that *neither* client size/growth *nor* agency costs explain a large portion of the demand for larger-sized or Big Eight auditors. While agency costs appear, at the margin, to affect auditor choice above and beyond client size/growth, the auditor selection process seems to be more complex than modelled in this and related studies.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

Articulation Problems Between the Balance Sheet and the Funds Statement

Mostafa M. Maksy

ABSTRACT: This Small Sample Study describes and illustrates two types of discrepancies that can occur between the change in certain balance sheet amounts as derived from comparative balance sheets and the change that is reported in the funds statement. Four possible causes for such discrepancies are discussed and disclosure policies that would help to overcome some possibly serious reporting deficiencies are suggested.

SHOULD the funds statement explain the changes in balance sheet amounts from period to period? Should the change in overall funds reported in the funds statement equal the change in overall funds that can be derived from comparative balance sheets? Generally accepted accounting principles (GAAP)—as expressed, for example, in Accounting Principles Board Opinion (APBO) No. 19 [1971] and in Statement of Financial Accounting Standards (SFAS) No. 95 [1987] which superseded it[1]—and the commentary in major accounting textbooks all indicate affirmative answers to the above questions. Yet an increasing number of published funds statements do not correctly, or at least adequately, reconcile certain changes in balance sheet amounts. In fact, the funds statements of some firms report a net change in funds which does not equal

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[1] APBO No. 19 [1971, par. 12] states [emphasis added]: "If the format shows the flow of working capital and two-year comparative balance sheets are presented, the changes in *each element of working capital* for the current period (but not for earlier periods) can be computed by the user of the statements. Nevertheless, the Board believes that the objectives of the Statement usually require that the net change in working capital be analyzed in appropriate detail in a tabulation accompanying the statement and, accordingly, this detail *should be fur-*

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the net change derived by comparing the opening and closing balances of the fund accounts (e.g., cash and equivalents, working capital) as reported in these companies' comparative balance sheets.

This Small Sample Study describes and illustrates two types of discrepancies between amounts reported in the funds statement and amounts derivable from comparative balance sheets. It also suggests disclosure policies that would help to overcome some of the more serious and/or obvious of these reporting deficiencies.

TWO TYPES OF DISCREPANCIES

Discrepancies between the changes reported in the funds statement and those indicated in comparative balance sheets may be classified into two types, as follows:

Type I Discrepancies

> Type I discrepancies arise when the changes in individual working capital accounts as reported in the funds statement do not equal the changes in these same accounts as derived from comparative balance sheets. For example, the funds statement may show an increase of $50 million in inventory, whereas the comparative balance sheets indicate an increase of $70 million. The change in overall funds as defined in the funds statement (e.g., net working capital or cash and cash equivalents), however, is equal to the change in overall funds derived from comparative balance sheets.

Type II Discrepancies

> Type II discrepancies arise when the change in overall funds (however defined) reported in the funds statement does not equal the change in overall funds derivable from comparative balance sheets. Typically, those published financial statements containing Type II discrepancies also include one or more significant Type I discrepancies.

As might be expected, Type I discrepancies appear to be much more prevalent than do Type II discrepancies. In most cases, Type I discrepancies are not significant in amount and are tolerated under GAAP because they are considered immaterial. In other cases, however, these discrepancies can be quite significant in size. Not providing an explanation of such Type I discrepancies in a footnote or elsewhere may leave the financial statement user in a difficult position. Type II discrepancies, regardless of magnitude, violate GAAP.[2]

Significant Type I Discrepancies

Table 1 provides 11 examples of significant and unexplained Type I discrepancies present in the published annual reports of ten different firms. A review of the data included in Table 1 leads to a number of observations:

1. The absolute dollar amount of Type I discrepancies in individual working capital operating accounts can be quite large. For example, the 1985 funds statement of United Technologies shows an increase in Accounts Payable and Accrued Liabilities of $584 million, whereas the increase derived from comparative balance sheets is only $256 million. Thus, the discrepancy in this combined account is $328 million.

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nished." Paragraph 26 of SFAS No. 95 [1987] states: "A statement of cash flows for a period shall report...the net effect of those flows on cash and cash equivalents during the period *in a manner that reconciles beginning and ending cash and cash equivalents*" [emphasis added].

[2] See footnote 1.

TABLE 1
EXAMPLES OF TYPE I DISCREPANCIES BETWEEN THE BALANCE SHEET AND THE FUNDS STATEMENT

		In $Millions			*Significance of the Discrepancies as a Percentage of*				
Company (*Year*) (*1*)	*Operating Working Capital Accounts* (*2*)	*Change per Balance Sheet* (*3*)	*Change per Funds Statement* (*4*)	*Unexplained Discrepancies*** (*5*)	*Change per Balance Sheet* (*6*)	*Change per Funds Statement* (*7*)	*Working Capital from Operations* (*8*)	*Net Income for Current Year* (*9*)	*Total Assets at End of Current Year* (*10*)
International Paper (1982)*	Accrued income taxes	$ +2.7	$−100.1	$+102.8	3,807.4	102.7	29.3	59.8	1.9
United Technologies (1985)	Current and long-term receivables	+115.866	+246.634	−130.768	112.9	53.0	27.3	42.0	1.2
	Inventories	−65.761	+90.405	−156.166	237.5	172.7	32.6	50.0	1.5
	Accounts payable and accrued liabilities	+256.155	+584.271	−328.115	128.1	56.2	68.5	105.0	3.1
	Total operating W/C***	−205.051	−247.232	+41.181	20.0	16.7	4.8	13.2	.4
Abbott Laboratories (1985)	Prepaid expenses and other current assets	+34.709	+134.619	−99.910	287.9	74.2	14.6	21.5	2.9
	Accounts payable and other current liabilities	+134.437	+147.765	−13.328	9.9	9.0	1.9	2.9	.4
Goodyear Tire and Rubber (1985)	Other W/C operating items	−64.0	−23.7	−40.3	63.0	170.0	3.7	9.8	.6
Bethlehem Steel (1985)	Receivables	+42.5	+14.7	+27.3	65.4	189.1	16.8	14.2	.6
	Inventories	−134.8	−177.9	+43.1	32.0	24.2	26.0	22.0	.9
	Accounts payable	−30.3	−38.8	+8.5	28.1	21.9	5.1	4.3	.2
	Other current liabilities	+6.4	−40.5	+46.9	732.8	115.8	28.3	23.9	1.0
	Total operating W/C	−68.4	−83.9	+15.5	22.7	18.5	9.3	7.9	.3
Boise Cascade (1985)	Receivables	−41.651	−11.284	−30.367	72.9	269.1	10.5	29.1	.9
	Inventories	−89.224	−37.807	−51.417	57.6	136.0	17.9	49.3	1.6
	Other current assets	−15.350	+2.165	−17.515	114.1	809.0	6.1	16.8	.5
	Accounts payable and accrued liabilities	−45.728	−110.444	+64.716	141.5	58.6	22.5	62.1	2.0
	Current and deferred income taxes	−3.978	−5.437	+1.459	36.7	26.3	.5	1.4	0
	Total operating W/C	−96.519	+68.955	−165.474	171.4	240.0	57.4	158.7	5.1

TABLE 1—*Continued*

Company (Year) (1)	*In $Millions* Operating Working Capital Accounts (2)	Change per Balance Sheet (3)	Change per Funds Statement (4)	Unexplained Discrepancies** (5)	*Significance of the Discrepancies as a Percentage of* Change per Balance Sheet (6)	Change per Funds Statement (7)	Working Capital from Operations (8)	Net Income for Current Year (9)	Total Assets at End of Current Year (10)
Borden, Inc. (1985)	Receivables, inventories and payables	+24.389	−16.117	+40.506	166.1	251.3	7.8	20.9	1.4
Bell & Howell (1985)	Receivables	−7.179	+18.297	−25.476	354.9	139.2	43.3	79.2	3.8
	Inventories	+26.979	+24.572	2.407	8.9	9.8	4.1	7.5	.4
	Other current assets	+10.681	+0.139	+10.542	98.7	7,584.2	17.9	32.8	1.6
	Operating current liabilities	+74.383	+27.310	+47.073	63.3	172.4	80.0	146.3	7.0
	Total operating W/C	−43.902	+15.698	−59.600	135.8	379.7	101.3	185.2	8.9
Staley Continental (1986)	Operating W/C (combined)	−29.904	−14.250	−15.654	52.3	109.9	9.0	59.8	.9
Goodyear Tire and Rubber (1984)	Accounts and notes receivable	−157.3	−78.7	−78.6	50.0	100.0	10.1	19.1	1.3
	Inventories	+114.5	+197.6	−83.1	72.6	42.1	10.7	20.2	1.3
	Current liabilities and prepaid expenses	+35.7	+68.4	−32.7	91.6	47.8	4.2	8.0	.5
	Operating W/C	−78.5	+50.5	−129.0	164.3	255.4	16.6	31.4	2.1
Masco Corp. (1985)	Receivables	+41.400	+31.870	+9.530	23.0	29.9	5.2	5.8	.5
	Inventories	+55.520	+5.180	+60.700	109.3	−1,171.8	33.2	36.9	3.4
	Total operating W/C	+96.920	+26.690	+70.230	72.5	263.1	38.4	42.7	3.9

Source: Annual reports of corporations listed in the Table for the years indicated.

* For 1981, International Paper's Funds Statement showed an *increase* in inventories of $54.6 million whereas the balance sheet indicated a *decrease* of $109.6 million. Similarly, the Funds Statement showed an *increase* of $78.4 in operating current liabilities (other than accrued income taxes), whereas the balance sheet indicated a *decrease* of $85.5 million in these same accounts. However, when these unexplained large differences are offset against each other the unexplained difference in operating working capital (other than accrued income taxes) becomes insignificant. Furthermore, these unexplained large differences may have been due to the sale of Canadian International Paper in 1981.

** Column (3) less Column (4).

*** W/C: Working Capital.

2. On a percentage basis, Type I discrepancies in individual working capital operating accounts can also be quite significant. For example, the discrepancy in United Technologies' 1985 financial statements referred to above represents 128 percent of the change in Accounts Payable and Accrued Liabilities derived from comparative balance sheets, 56 percent of the change in that combined account reported in the funds statement, 68 percent of working capital from operations for 1985, and 105 percent of net income for 1985. Corresponding percentages for some other companies are even higher.
3. The absolute dollar amount of Type I discrepancies in *total* operating working capital is, in many cases, not as large as the discrepancies in *individual* operating working capital accounts. In the United Technologies case, for example, the discrepancy in total operating working capital is only $41 million. This would seem to indicate that some large Type I discrepancies in individual operating working capital accounts offset each other.
4. On a percentage basis, Type I discrepancies in total operating working capital are likewise not as significant as the discrepancies in individual operating working capital accounts. Looking again at the United Technologies case, we can see that the discrepancy in total operating working capital represents 20 percent of the change in total operating working capital derived from comparative balance sheets, about 17 percent of that change as reported in the funds statement, about five percent of working capital from operations for 1985, and about 13 percent of net income for 1985.
5. Type I discrepancies, whether in individual operating working capital accounts or in total operating working capital, are usually not significant when measured as a percentage of total assets at the end of the year in which those discrepancies arise. A review of col. 10 in Table 1 supports this observation. All the percentages in this column are less than five percent, with the exception of the total operating working capital for Boise Cascade (5.1 percent) and Bell & Howell (8.9 percent) and the current operating liabilities for Bell & Howell (7.0 percent). The reason for this is most likely that the SEC requires separate balance sheet disclosure for any item that represents five percent or more of total assets.

Significant Type II Discrepancies

Type II discrepancies—regardless of magnitude—violate GAAP. Despite this, a variety of such discrepancies can be found. Two of these are identified and discussed in the paragraphs that follow.

Bally Manufacturing Corporation. Bally's comparative balance sheets indicate that working capital decreased by $122.310 million from 1983 to 1984, whereas its 1984 funds statement reports a decrease in working capital, grouped under the caption "Investment in Working Capital," of $80.371 million (see Exhibit 1). A discrepancy also exists with respect to the change in cash and equivalents. The funds statement reports a decrease of $7.511 million, whereas the comparative balance sheets indicate a decrease of only $6.884 million.

While it has been most common to

EXHIBIT 1
BALLY MANUFACTURING CORPORATION

Bally Manufacturing Corporation

Consolidated Statement of Changes in Financial Position

	Years ended December 31		
	1984	*1983*	*1982*
			(In thousands)
Funds provided:			
From operations—			
Net income (loss)	$(100,411)	$ 5,158	$ 90,978
Items not involving funds:			
Depreciation and amortization	115,696	99,843	80,561
Provision for restructuring amusement game business	93,800	—	—
Net book value of property, plant and equipment disposals	16,020	8,735	17,090
Deferred income taxes	(25,529)	(3,357)	(611)
Minority interests in net income of subsidiaries	2,741	3,078	1,728
Total from operations	102,317	113,457	189,746
From capital transactions—			
Proceeds from exercise of stock options	—	5,938	5,980
Sale of common stock purchase warrants	—	2,251	—
Issuance of treasury stock to benefit plans	2,647	—	—
Minority interests and other	—	5,000	10
Total funds provided exclusive of borrowed funds	104,964	126,646	195,736
Less—Cash dividends	(5,203)	(5,274)	(3,976)
Purchase of treasury stock	(17,342)	—	—
Net funds before financing	82,419	121,372	191,760
From debt financing activity—			
15% Subordinated Debentures due 1999	125,000	—	—
13⅞% Mortgage-Backed Bonds due 2003	—	99,503	—
10% Convertible Subordinated Debentures due 2006	—	—	100,000
Scheduled repayments of long-term debt	(17,647)	(12,406)	(13,678)
Other increases (decreases) in long-term debt	39,973	69,228	(16,528)
Increase (decrease) in short-term debt	7,459	(23,246)	35,445
Debt issuance costs	(5,625)	(3,452)	(1,483)
Net funds from financing	149,160	129,627	103,756
Funds available for investment	$ 231,579	$250,999	$295,516

define "funds" as either working capital *or* cash and equivalents, Bally uses neither definition. It defines funds as operating working capital *including* cash and equivalents, that is, nonoperating working capital accounts such as notes payable and current maturities of long-term debt are excluded. However, the change of $72.267 million in operating working capital (including cash and equivalents) derived from comparative balance sheets (see Table 2) does not equal the change in funds of $80.371 million reported in the funds statement (Exhibit 1). Excluding cash and equivalents, the change in operating working

EXHIBIT 1—*Continued*

	Years ended December 31		
	1984	*1983*	*1982*
			(*In thousands*)
Investment activity:			
Working capital—			
Cash and equivalents	$ (7,511)	$ (12,804)	$ (5,617)
Receivables	11,678	28,467	1,168
Inventories	(45,193)	(11,676)	(11,114)
Accounts payable and accrued liabilities	(37,226)	5,735	(4,302)
Income taxes payable and deferred income taxes	5,349	(12,486)	12,044
Other, net	(7,468)	(16,863)	14,308
	(80,371)	(19,627)	6,487
Property, plant and equipment expenditures	158,533	165,052	110,774
Acquisitions of businesses	145,933	92,332	178,902
Other, net	7,484	13,242	(647)
Funds used for investment	$ 231,579	$250,999	$295,516

See accompanying notes.

Source: Bally Manufacturing Corporation, 1984 Annual Report, page 26.

capital derived from comparative balance sheets should be $65.383 million, but in the funds statement it is reported as $72.860 ($80.371 − $7.511) million.

Both Bally and Arthur Young & Co., its independent auditor, were queried regarding this Type II discrepancy. The Arthur Young partner in charge of Bally's audit explained that the 1983 acquisition price for the Health and Tennis Corporation of America was not allocated to individual balance sheet line items by year's end. In addition, he stated that a portion of the discrepancy may have been caused by foreign currency translation adjustments. Telephone interviews with two corporate controllers from other firms indicated that the valuation of acquired assets could indeed be quite complex and might take up to 18 months to complete.

A review of the footnote on acquisitions in Bally's 1983 annual report confirmed that the *actual* allocation of the purchase price for the Health and Tennis Corporation of America was not completed by December 31, 1983. However, it also indicated that a *preliminary* allocation was made. While this preliminary allocation was reflected in the ending balances of the balance sheet, it was not reflected in the changes reported in the funds statement. This is perhaps one of the major reasons for the Type II discrepancy.

A comparison of the December 31, 1983 balance sheet amounts in Bally's 1983 and 1984 annual reports does reveal that by the end of 1984 the company had made one or more reclassification journal entries related to income tax accounts as of December 31, 1983. They had the following cumulative effect (in thousands of dollars):

TABLE 2
CHANGE IN BALLY'S OPERATING WORKING CAPITAL DURING 1984
(IN THOUSANDS OF DOLLARS)

	December 31		*Increase (Decrease)*
	1984	*1983*	
Current Assets			
Cash and equivalents	$ 38,978	$ 45,862	$ (6,884)
Receivables, net	212,209	209,075	3,134
Refundable income taxes	66,872	38,802	28,070
Inventories (total)	54,694	92,259	(37,565)
Current assets	27,540	24,483	3,057
Total (A)	$400,293	$410,481	$(10,188)
*Current Liabilities**			
Accounts payable	$ 44,502	$ 45,238	$ (736)
Income taxes payable	9,000	8,500	500
Deferred income taxes	30,326	36,636	(6,310)
Deferred revenues	51,259	34,264	16,995
Accrued liabilities	137,926	86,296	51,630
Total (B)	$273,013	$210,934	$ 62,079
Operating Working Capital (A−B)	$127,280	$199,547	$(72,267)
Less: Cash and Equivalents**	38,978	45,862	(6,884)
Operating Working Capital excluding Cash	$ 88,302	$153,685	$(65,383)

* Notes payable and current maturities of long-term debt are excluded as non-operating.
** Cash and equivalents balance could be the result of operating or non-operating transactions.

Refundable Income Taxes	38,802	
Income Taxes Payable	15,179	
Deferred Income Taxes—Current		36,636
Deferred Income Taxes—Noncurrent		17,345

However, the Type II discrepancy in the 1984 annual report relates to *all* operating working capital accounts, not only to income taxes.

A further comparison of the 1983 funds statement amounts in Bally's 1983 and 1984 annual reports reveals that the $38,802 debit to refundable income taxes appears to have been treated in the funds statement as an increase in receivables. This observation is supported by the fact that the funds statement comparison results in one or more reclassification journal entries having the following cumulative effect (in thousand of dollars):

Receivables	38,802	
Deferred Income Taxes—Noncurrent	13,324	
Income Taxes Payable and Deferred Income Taxes—Current		52,126

Other than for the accounts noted in the above two entries, the 1983 changes in all balance sheet line items reported in the funds statement were the same in the 1983 and 1984 annual reports. It is not clear why the change in refundable income taxes derived from comparative balance sheets is treated in the funds statement as a change in receivables. In any case, this different treatment does not resolve the problem at hand. The change in operating working capital as reported in the funds statement is not equal to what may be derived from comparative balance sheets. The effect of foreign currency translation adjustments on the discrepancies cannot be assessed from the information disclosed in Bally's 1983 and 1984 annual reports.

When queried about this Type II discrepancy, Bally's manager of financial reporting provided the Changes in Financial Position Worksheet in Exhibit 2. Exhibit 2 reveals that the portion of the $145.933 million acquisition price representing current assets and current liabilities is not broken down by major categories so that an analyst can determine the components of the $80.371 million change in operating working capital. In addition, the worksheet does not explain the nature of, or reason for, the figures in the column labeled "other, net," particularly the $13.338 million relating to changes in other assets. Finally, the working capital portion ($2.755 million) of the above-mentioned acquisition price is reported in the funds statement as a use of working capital. Normally, only that portion of the acquisition price which relates to nonworking capital items is reported as a use of working capital in funds statements.

American Standard, Inc. The comparative 1984 and 1985 balance sheets of American Standard indicate an increase in cash and certificates of deposits of $62.833 million, whereas its 1985 funds statement reports an increase of only $47.903 million in these two accounts. When queried about the reason for this Type II discrepancy, American Standard's controller replied:[3] "The discrepancy is due to the effect of exchange rate changes." He emphasized the note at the bottom of the funds statement stating that "the changes shown are changes in local currency balance sheet accounts translated at the exchange rates at the end of the period." He also said that American Standard is "probably the only company in the U.S. that is using the correct method since our funds statement reflects the *true* [not fictitious] cash flows—the cash shown on the balance sheet includes the impact of changes in foreign exchange rates." He added: "Finally the Financial Accounting Standards Board is recommending our method in the new Exposure Draft: 'Statement of Cash Flows' [1986]."[4]

American Standard's controller was then asked how the statement's users would know that the discrepancy between the balance sheet and the funds statement was due to the effect of exchange rate changes and not to other reasons, such as unintentional errors. In response, he volunteered to provide the information in Exhibit 3 showing a breakdown, by foreign countries, of the effect of exchange rate changes. As Exhibit 3 indicates, the total effect of exchange rate changes equals exactly the difference between the change in cash and certificates of deposits reported in the funds statement and that derivable from comparative balance sheets.

Although Exhibit 3 does indicate that

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[3] In a telephone conversation between the author and Mr. Neil Raynor on September 17, 1986.

[4] This conversation occurred before the Exposure Draft was issued as SFAS No. 95 in November 1987. However, a comparison of SFAS No. 95 and the Exposure Draft reveals that the points covered by the conversation are the same in both documents.

EXHIBIT 2

BALLY MANUFACTURING CORPORATION CHANGES IN FINANCIAL POSITION WORK SHEET
YEAR ENDED DECEMBER 31, 1984
(SOURCES (USES)—DOLLARS IN THOUSANDS)

	December 31,													
	1984	*1983*	*Net Changes*	*LESS: Acquisition Balance Sheets*	*Adjusted Net Changes*	*Total from Operations*	*From Capital Transactions*	*Cash Dividends*	*Purchase of Treasury Stock*	*Net Funds from Financing*	*Working Capital, Net*	*Property, Plant, and Equipment Expenditure*	*Acquisitions of Businesses*	*Other, Net*
Current assets	400,293	410,481	(10,188)	33,130	(43,318)									
Current liabilities	373,189	261,067	112,112	30,375	81,747									
Net working capital	27,104	149,414	(122,310)	2,755	(125,065)					44,994	80,371			(300)
Long-term receivables, net	13,536	14,795	(1,259)	0	(1,259)									1,259
Property, plant, and quipment, net	850,127	740,886	109.241	112,108	(2,867)	161,073						(158,533)		327
Other assets	101,752	92,873	8,879	1,429	7,450	11,513				(6,626)				(13,338)
Intangible assets, net	104,522	80,812	23,710	43,969	(20,259)	21,530								(1,271)
Long-term debt, less current maturities	622,510	0	38,930	0	38,930	31,400				109.791				
Other long-term liabilities	38,930	0	38,930	0	38,930	31,400								7,530
Deferred income taxes	36,452	53,428	(16,976)	8,553	(25,529)	(25,529)								
Minority interests	30,428	27,813	2,615	0	2,615	2,741								(126)
Stockholders' equity	368,721	490,595	(121.874)	0	(121,874)	(100,411)	2,647	(5,203)	(17,342)					(1,565)
Acquisition of businesses	0	0	0	145,933	(145,933)								(145,933)	
						102.317	2,647	(5,203)	(17,342)	149.160	80,371	(158,533)	(145,933)	(7,484)

Source: Bally Manufacturing Corporation's Manager of Financial Reporting (Mr. Jerald Greenberg) with a letter dated December 31, 1985.

Exhibit 3

American Standard, Inc.
Effect of Changes in Foreign Exchange Rates on Cash
(Dollars in thousands)

Country	*12/31/85 B/S Rate*	*12/31/84 B/S Rate*	*Variation*	*Cash*	*Foreign Exchange Effect*
Australia	0.6825	0.826	−0.1435	$ 0	$ 0
Austria	0.0581	0.0453	0.0128	4,039	52
Belgium	0.01992	0.01582	0.0041	31,172	128
Canada	0.7153	0.7576	−0.0423	5,680	−240
England	1.4452	1.1592	0.286	5,626	1,609
France	0.1333	0.1039	0.0294	2,202	65
Germany	0.409	0.3175	0.0915	121,084	11,079
Greece	0.0068	0.0078	−0.001	63,150	−63
Holland	0.3631	0.2813	0.0818	1,080	88
Italy	0.601	0.517	0.084	21,931	1,842
Sweden	0.1325	0.1115	0.021	6,483	136
Switzerland	0.4859	0.3846	0.1013	2,309	234
					$14,930

Source: American Standard, Inc.'s Controller's Office, with a letter to the author dated September 30, 1986.

no mathematical errors exist, it was not cited in the footnote on foreign currency translation so that all users of the annual report could have such information. In addition, the effect of exchange rate changes was broken down by foreign countries but not by major balance sheet categories (e.g., receivables, inventories, payables, and properties). As will be explained below, analysts might benefit if these effects on balance sheet categories, particularly on working capital operating items, were disclosed.

It is true that the FASB has concluded in its Exposure Draft [par. 67] that the effect of exchange rate changes on items *other than cash* is not an operating, investing, or financing activity and, therefore, should not be presented on a statement of cash flows. However, the Exposure Draft differs in two major respects from American Standard's reporting practice:

1. American Standard translates *changes* from the beginning to the end of the year in local currency balance sheet amounts (which represent either cash inflows or outflows) using exchange rates *at the end of the period*, whereas, the Exposure Draft requires the use of exchange rates *at the time of the cash inflows and outflows* [par. 13].[5]
2. American Standard's funds statement shows an increase in cash and certificates of deposit which is lower by $14.930 million than the increase derived from comparative balance sheets (i.e., a Type II discrepancy), whereas, the Exposure Draft requires that the "statement

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[5] The Exposure Draft [par. 13] also states that if this is impractical, an appropriate *weighted average* exchange rate for the period may be used for translation.

> should *identify separately* the effect of exchange rate changes *on cash balances* held in local currencies *and report that effect as part of the reconciliation of the change in cash during the period*" [par. 13].

Thus, while the FASB is willing to permit a Type I discrepancy, it is not willing to permit a Type II discrepancy. The FASB affirms this specifically (in the Exposure Draft [par. 8]): "A statement of cash flows shall *explain the change during the period in cash and cash equivalents.*"

CAUSES OF DISCREPANCIES

Based on analyses of published financial statements of many companies and on discussions with their corporate controllers, the types of discrepancies discussed in this paper can be attributed to one or more of the following items:

1. Acquisitions and/or divestitures of businesses.
2. Discontinued operations.
3. Foreign currency translation adjustments.
4. Deferred income taxes.

Following is a discussion of why each of the above items leads to discrepancies between the balance sheet and the funds statement.

Acquisitions and/or Divestitures of Businesses

When a company acquires a business during the fiscal year and the acquisition is accounted for as a purchase, the transaction is recorded by debiting assets acquired and crediting liabilities assumed with the difference being credited to cash and/or debt or capital stock issued for this purpose. Given this entry, the changes in individual balance sheet line items during the year will reflect the amount added through acquisition as well as the change resulting from the parent company's own business transactions. However, while these changes are reflected fully on the balance sheet, some companies reflect only the second change on the funds statement, leaving the change due to acquisition as a separate line item.

Companies vary as to their reasons for this practice. Staley Continental's controller stated:[6] "If we do not report the acquisition price on a separate line in the funds statement, we receive many inquiries from analysts about the acquisition price. Thus, we prefer to disclose that price on a separate line rather than allocate it with the changes for major balance sheet categories." Other companies may do so on the assumption that the funds statement should reflect only the changes in balance sheet amounts resulting from the parent company's own transactions; any changes in balance sheet amounts resulting from other transactions, such as acquisitions, should be reported separately. They argue that this reporting approach is beneficial to analysts. For example, if receivables increased on the balance sheet by $5 million (say, from $10 to $15 million) but $3 million of this increase was due to adding the acquired subsidiary's receivables, analysts may believe that receivables increased by 50 percent when, in fact, the increase from the parent company's business transactions was only 20 percent. The other 30 percent increase simply happened on one day, the date of acquisition.

The benefit is achieved fully if the increase in receivables from acquisitions is separately disclosed. If, however, that increase in receivables is lumped with changes (from acquisitions) in other balance sheet line items and reported as one line item in the funds statement, such benefit will not be achieved.

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[6] In a telephone conversation with Mr. Michael W. Urbut on February 19, 1987.

Discontinued Operations

When a company decides to discontinue a segment of its business, it should, under GAAP, report the net of tax income or loss from discontinued operations on a separate line in the income statement after income from continuing operations. Few companies, however, separate the assets of the discontinued businesses in the balance sheet. In addition, they normally only disclose the changes in current assets and current liabilities that are related to continued operations in their funds statements. The changes related to discontinued operations are normally relegated to an item labeled as "other, net."

While this reporting practice may be tolerated on the assumption that assets and liabilities of discontinued operations are usually not material in relation to those of continuing operations, the "other, net" item may include some offsetting items. This can hinder the analyst's ability to reconstruct certain business transactions and gain insights about the company's operations and performance.

Foreign Currency Translation Adjustments

In a survey of financial executives of multinational companies, Seed [1984] found that foreign currency translation adjustments represent the most troublesome technical problem associated with the funds statement. Little guidance in respect to this problem, however, is provided in SFAS No. 52 [1981]. Each company is left to experiment with the problem as best it can. The Seed survey found four alternative methods for including foreign currency translation effects in the funds statement. These are listed below:

1. Combine the effects with the category titled "other items," especially if such effects are not material.
2. Show the effects as a single line item (as required by SFAS No. 95).
3. Analyze on a multiple line basis the components of the funds statement affected by foreign currency translation adjustments.
4. Compute the actual effects of foreign currency translation on each component of the funds statement and show the adjustment for each line item in a footnote.

Multinational companies appear to favor the less complicated approaches (i.e., alternatives 1 and 4 above). Seed's survey findings parallel those of Coopers & Lybrand [1982], who studied the 1981 annual reports of 158 companies and discovered the following pattern of practice.

	Percent of Total
No separate presentation (alternatives 1 & 4)	44
One-line presentation (alternative 2)	42
Multiple-line presentation (alternative 3)	14
	100

As discussed in the previous section, at least one company, American Standard, chose not to report the effects of foreign currency translation at all in its funds statement. As a result, the change in cash and certificates of deposit reported in its funds statement differed by $14.930 million from the change in these two accounts derived from comparative balance sheets. Excluding foreign currency translation effects entirely from the funds statement, as was done by American Standard, results in a discrepancy between the funds statement and the balance sheet.

Deferred Income Taxes

Under current GAAP, deferred income taxes are classified on the balance sheet as current or noncurrent, depending on the classification of the asset or liability to which the deferral relates.[7] With respect to the funds statement, companies use one of the following reporting alternatives:[8]

1. Report, separately from each other, the change in each income tax account (e.g., current income taxes payable or prepaid income taxes, current deferred income taxes, noncurrent deferred income taxes).
2. Report the change in all income tax accounts combined in one line.
3. Combine the change in current deferred income taxes with the change in current income taxes payable and report that figure separately from the change in noncurrent deferred income taxes.
4. Report the change in noncurrent deferred income taxes separately and combine the change in current deferred income taxes and in current income taxes payable with other changes in operating working capital accounts.
5. Report the change in deferred income taxes (both current and noncurrent combined) separately from the change in current income taxes payable (e.g., Wendy's 1985 funds statement).
6. Report the change in deferred income taxes (both current and noncurrent combined) separately and combine the change in current income taxes payable with other changes in operating working capital accounts (e.g., Staley Continental's and International Paper Company's funds statements for 1986).
7. Report the change in noncurrent deferred income taxes combined with other items, and the change in other income tax accounts combined with other changes in noncash working capital (e.g., Amoco Corporation's 1986 funds statement).
8. Combine the changes in all income tax accounts with other changes in operating working capital (e.g., funds statement of Abbott Laboratories for 1985).

Alternatives 7 and 8 and/or the practice of combining some income tax accounts with other accounts in the balance sheet make it very difficult for users interested in calculating the amount of income taxes paid during the period. The amount of income taxes paid may be useful in cash flow analysis. It may also be useful in estimating the cash tax rate (the amount of taxes paid as a percentage of pretax income), which may be used in some cash flow prediction models (e.g., Bernstein and Maksy [1986, p. 117]).[9]

To illustrate, an examination of Staley

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[7] A deferred charge or credit that is not related to an asset or liability because (a) there is no associated asset or liability or (b) reduction of an associated asset or liability will not cause the timing difference to reverse shall be classified based on the expected reversal date of the specific timing difference [SFAS No. 37, "Balance Sheet Classification of Deferred Income Taxes," 1980, par. 4].

[8] The actual funds statements illustrating *all* of these income tax reporting alternatives are available from the author upon request.

[9] SFAS No. 95, issued in November 1987 long after this paper was first drafted, requires separate disclosure of the amount of income taxes paid [par. 27 and 29]. As a result, the importance of this suggestion is considerably diluted.

Continental's funds statement for 1986 reveals that their deferred income taxes increased by $16.447 million. However, the increase in noncurrent deferred income taxes derivable from Staley Continental's comparative balance sheets is only $12.378 million. These balance sheets do not disclose beginning and ending balances for current deferred income taxes. Queried about the $4 million discrepancy, Staley Continental's controller replied that it was "related to current assets and liabilities and included in the balance sheet with 'other current assets.'" When asked why beginning and ending balances of the current deferred income tax were not reported separately in the balance sheet, the controller said: "Because each was less than five percent of total assets and, thus, not required by SEC rules to be reported separately in the balance sheet." While Staley Continental's reporting meets all current GAAP and the Securities and Exchange Commission (SEC) rules, it complicates income tax analysis, as discussed above.

IMPLICATIONS FOR FINANCIAL STATEMENT USERS

Uses of Funds Statement Data. The relevant literature on funds statements goes back to at least 1963, when APBO No. 3 [1963] recommended, but did not require, presentation of a statement of sources and applications of funds as supplementary information in financial reports. By 1971, APBO No. 19 required the inclusion of such a statement. Finally, in late 1987, the FASB issued SFAS No. 95 which superseded APBO No. 19 and narrowed the acceptable definition of funds to "cash and cash equivalents."

Throughout this twenty-four-year period a variety of uses for funds statement data was cited by both the APB and the FASB, prominent academics, and other interested parties. References were made, for example, to the following uses:

> To. . . provide valuable insight into such matters as:
>
> > (1) future dividend policy, (2) the financing of capital expenditures and the extent to which additional debt and/or equities may be issued to finance same, and (3) the ability to meet debt service requirements [FAF, 1964, p. 33].
>
> To provide a basis for assessing future cash flows by providing information about past cash flows or some other type of funds flow [FASB, 1980, pp. ii, 26].
>
> To provide a basis for identifying the relationship between income and net cash flows [FASB, 1980, pp. ii, 26].
>
> To provide feedback (i.e., to provide a basis for making comparisons with earlier assessments of cash flows) [FASB, 1980, pp. ii, 27].
>
> To provide a basis for assessing the "quality" of income. The measurement of funds flows is perceived as being more reliable and more objective than the measurement of income because the latter involves more judgment about accruals, allocations, and valuations [FASB, 1980, pp. ii, 27].
>
> To improve the comparability of information in financial reports. Differences due to different accounting methods for inventory and estimated useful lives used in computing depreciation expenses do not affect funds flow [FASB, 1980, pp. ii, 27].
>
> To provide a basis for assessing performance. Relationships involving funds flow (e.g., the ratio of funds provided by operations to funds invested in the business—the recovery rate) may provide a useful measure of enterprise performance [FASB, 1980, pp. ii, 28].

> To...assess the reasons for differences between net income and associated cash receipts and payments [SFAS No. 95, par. 5].
>
> To...assess the effects on an enterprise's financial position of both its cash and noncash investing and financing transactions during the period [SFAS No. 95, par. 5].

Significance of Discrepancies. Both APBO No. 19 [1971] and SFAS No. 95 [1987], which superseded it, require that the change in funds reported in the funds statement must equal the change in funds derivable from comparative balance sheets.[10]

The lack of articulation between the balance sheet and the funds statement may have the following practical consequences:

1. *Users may be confused and the usefulness of the funds statement undermined.* An analysis of the uses of the funds statement data discussed above indicates that most of these uses center around an appropriate determination of cash flows from operating activities and an assessment of the reasons for differences between that amount and net income. An inaccurate determination, or a confusion as to which numbers to use in a determination, of cash flows from operations would undermine the uses of the funds statement. The cash flows from operating activities may be calculated using the direct method or the indirect (reconciliation) method.[11] In the latter case, if the required adjustments as reported in the funds statement are different from those derivable from comparative balance sheets, analysts will not know whether to use the cash flow from operations reported in the funds statement or to compute that key measure themselves using changes derivable from comparative balance sheets.[12]
2. *There is a lack of feedback.* The Seed [1984] survey of individual investors, financial analysts, and commercial bankers indicates that one of the uses of the funds statement is to compare its data with the income statement and the balance sheet. If, for example, comparative balance sheets indicate an increase in an operating working capital item (e.g., receivables, inventories, or payables), users may reasonably

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[10] Paragraph 7 of SFAS No. 95 states: "A statement of cash flows *shall explain the change during the period* in cash and cash equivalents....The total amounts of cash and cash equivalents at *the beginning and end of the period* shown in the statement of cash flows *shall be the same amounts* as similarly titled line items or subtotals shown in the statements of financial position as of those dates."

[11] Under the direct method, major classes of gross cash receipts and gross cash payments and their arithmetic sum—the net cash flow from operating activities—are reported. Under the indirect method, net income is adjusted for changes in operating working capital items. It is also adjusted to remove the effects of all items whose cash effects are investing or financing cash flows, such as depreciation, amortization of goodwill, and gains and losses on sales of property, plant, and equipment and discontinued operations (related to investing activities), and gains and losses on extinguishment of debt (a financing activity).

[12] It may be argued that few analysts would any longer compute changes from comparative balance sheets now that companies are required by SFAS No. 95 to report cash flow from operating activities in the statement of cash flows. However, those few analysts that do may be able to uncover possible improprieties that would not have been uncovered otherwise, as the *Wall Street Journal* story [September 28, 1983], regarding Baldwin-United seems to indicate. When Seed [1984] asked the analyst credited with uncovering the problems with Baldwin-United what role the funds statement played in his analysis, he said "it is always central and in this case was crucial." When he examined Baldwin-United's funds statement, he noticed the substantial addition to investments and wanted to understand where the money *was coming from* and *where it was used.* This led him to evaluate the statutory statements filed with the State Insurance Commission, which showed losses on a statutory basis.

expect that the funds statement will explain that increase. In fact, according to the above survey [pp. 18-19], 63 percent of individual investors, 80 percent of analysts, and 91 percent of commercial bankers reported that they "often" or "occasionally" use the funds statement for that purpose.

SUMMARY

This paper has described and illustrated two types of discrepancies that can occur between amounts reported in the funds statement and amounts derivable from comparative balance sheets for the same balance sheet line items. It also discussed possible causes for these discrepancies. Some of the more widely cited uses of the funds statement were also noted along with a discussion as to how the more serious discrepancies appeared to undermine such uses.

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EDUCATION RESEARCH

Frank H. Selto, Editor

The Controllability Principle in Responsibility Accounting

Rick Antle and Joel S. Demski

ABSTRACT: The purpose of this paper is to examine controllability: the notion a manager should be evaluated based on that which she or he controls. We embed the managerial evaluation problem in a principal-agent setting and ask whether the optimal agency solution bears any logical relation to a casual definition of controllability. It does not. More to the point, the agency framework compels us to look at information content. This information content perspective, upon reflection, agrees with our intuition, with our anecdotal impressions of practice, and with the dictates of the principal-agent model. Moreover, there is a well-defined relation between information content and a notion of control. Thus, the information content perspective may be thought of as offering a precise definition of controllability.

SHOULD a manager be evaluated as the head of a cost center or a profit center? Our familiar and intuitive analysis of this perennial question focuses on whether the manager *controls* cost and revenue. If so, the manager should be evaluated as the head of a profit center. If the manager only controls cost, a cost center evaluation is appropriate. If the manager only controls revenue, a revenue center evaluation is appropriate.

Analyzing this wisdom requires two specifications. First, we must be precise about what it means for the manager to "control" cost or revenue. Second, we must be precise about what it means to evaluate the manager "correctly" or in the "best possible manner."

We use a principal-agent model to

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provide a coherent framework for the evaluation exercise. This gives a setting where a nontrivial control problem is present, where evaluation of the manager can be explicitly modeled, and where managerial evaluation can be endogenously specified. In this way a control problem is modeled as an exercise in motivating a particular behavior by the manager, and performance evaluation as producing information relevant to the question of whether the desired behavior was supplied. The focus is on control of inputs, not outputs. Managerial evaluation, then, becomes framed in terms of inferring this supply of input.

In turn, we specify what it means for the manager to "control" an evaluation statistic, such as cost or revenue, by asking whether his or her supply of inputs is able to affect the probability distribution of the output statistic. For example, if cost is characterized as a probability distribution, can the manager affect this distribution by altering her or his managerial inputs?

This particular definition is highly stylized, but expositionally convenient. A result is that the principal-agent analysis leads to a focus related to, but distinct from, this notion of controllability. In particular, the principal-agent analysis leads us to ask whether the manager can affect the probability distribution of the output statistic *conditioned on whatever other information is present.* The intuition for this conclusion is best developed by beginning with a stylized notion of controllability, and then refining it to match the principal-agent conclusion. In this way the principal-agent paradigm is used to infer a formal definition of controllability. For exposition purposes, we refer to the performance evaluation dictates of the principal-agent model as the *information content* approach and the casual controllability definition as the (traditional) *controllability* approach.[1]

The paper is organized as follows: In Section I we present three numerical examples that explore the traditional controllability notion in a principal-agent setting. In Section II we introduce the information content perspective and use it to explain the anomalies in the earlier examples. In Section III we illustrate this perspective with a brief analysis of tournaments. Conclusions are offered in Section IV.

I. SOME EXAMPLES

Basic Model

Consider a setting where an individual, termed a principal, owns a production function that offers uncertain cash flow prospects. Three items of cash flow are identified: cash inflow from customers (revenue), cash outflow for materials and overhead (cost), and cash outflow to compensate the supplier of labor (wage). The revenue and cost amounts depend on which state of nature obtains as well as whether labor supply is "LOW" or "HIGH." There are three equally likely states of nature. The possibilities are described in Table 1 (000 omitted).

The principal faces two options, whether to input labor supply HIGH or LOW. She is risk neutral and, therefore, evaluates the options in terms of the expected value of the net profit they promise. To complete the analysis, we must specify the labor cost, or wage.

Labor is supplied by a second individual, termed an agent (or manager). Three characteristics of this second indi-

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[1] We emphasize our particular controllability rhetoric is designed to build intuition. Earlier authors, such as Ferrara [1967], were not as narrow in their conception of controllability. On the other hand, we use the formality of the principal-agent paradigm to propose a precise notion of controllability.

TABLE 1

REVENUE, COST, AND GROSS PROFIT FOR EXAMPLE 1

		State		
		s_1	s_2	s_3
LOW Labor Supply:	Revenue	800	1000	1000
	Cost, exclusive of labor	400	500	500
	Profit, exclusive of labor cost	400	500	500
HIGH Labor Supply:	Revenue	800	1000	1000
	Cost, exclusive of labor	400	400	500
	Profit, exclusive of labor cost	400	600	500

vidual are important. First, he is strictly risk averse, and values his wage compensation according to the expected value of $[\text{wage}]^{1/2}$. In this way, both individuals are important in the production process. The agent supplies labor, while the risk neutral principal supplies risk carrying capacity.[2]

Second, labor supply by the agent is personally costly. He prefers LOW to HIGH. In fact, his preference for wage (w) and labor supply (l) is given by the additive function $[w]^{1/2}-V(l)$, with $V(\text{LOW})=0$ and $V(\text{HIGH})=50$. In this way the supplier of labor is not an indifferent automaton. He and the principal are in conflict. She prefers HIGH, while he prefers LOW, other things equal.[3]

Third, the agent is not being held captive. He is free to work for the principal, or to work "elsewhere." Working elsewhere nets the agent an expected utility of 250 utiles. (For example, it offers a wage of $(250)^2$, and $V(\cdot)\equiv 0$.) The principal must match this to secure the agent's employment.

With these details in place, we can calculate the cost of labor. If the agent is to supply $l=\text{LOW}$, he must face a wage, denoted w_L, such that $[w_L]^{1/2}-0\geq 250$. Otherwise, he does better by working elsewhere. This implies $w_L\geq(250)^2=62{,}500$. Similarly, to provide $l=\text{HIGH}$, the principal must offer a wage, denoted

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[2] Risk is noxious to the agent and a matter of indifference to the principal. Efficiency dictates the principal shoulder the risk. In this way we view the principal as a loose caricature of a capital market.

More specifically, contrast the agent's thoughts about receiving $500 for certain or flipping a fair coin where with probability 1/2 he "wins" 1000 and with probability 1/2 he "wins" nothing:

$$[500]^{1/2}=22.36>1/2[1000]^{1/2}+1/2[0]^{1/2}=15.81$$

Concavity of $[\cdot]^{1/2}$ guarantees the agent will reject fair gambles. He considers risk noxious. The principal, however, is indifferent between the two options:

$$500=1/2[1000]+1/2[0].$$

[3] The idea is the two individuals face some conflict in the employment relationship. In a larger model this might arise over human capital concerns, over taste for a particular style of administration or set of products, or whatever. The most straightforward way is to assume some type of nonpecuniary cost befalls the agent. We further model this in a separable manner, so the conflict does not interact with the agent's wage. While unrealistic, this allows us to examine the controllability dictates in a transparent setting.

w_H, such that $[w_H]^{1/2}-50\geq 250$. This implies $w_H\geq(300)^2=90{,}000$.[4]

The principal, of course, will pay what the "market demands." Combining these labor cost calculations with the earlier (gross) profit data, we conclude with the following analysis of the principal's decision (000 omitted).

	Labor Supply	
	LOW	*HIGH*
E(Revenue)	933.33[5]	933.33
Less E(Cost)	466.67[6]	433.33[7]
E(Gross profit)	466.67	500.00
Less Wage	62.50	90.00
E(Net profit)	404.17	410.00

Evaluation Context

To this point there is little interest in evaluating the agent. The principal prefers labor supply HIGH, while the agent prefers LOW. But we have implicitly assumed the agent, in exchange for appropriate compensation, supplies the agreed upon amount. If this assumption is accurate, there is no interest in verifying the agent's labor supply.

Now move to the opposite extreme and assume the agent operates in his self interest. Further assume only the realized cost (exclusive of labor payment) and revenue are jointly observable and verifiable. Thus, the contract with the agent can call for payment as a function of the gross profit, but not as a function of the labor input actually supplied. The actual labor input is not verifiable and, therefore, not available as a basis for contracting.

This final verifiability assumption is important because it allows the agent room to maneuver in exploiting the natural conflict between principal and agent. In particular, suppose the principal offers a guaranteed wage of $w_H=90{,}000$ in exchange for supply of input HIGH. The agent can supply HIGH, with a resulting utility measure of $[90{,}000]^{1/2}-50=250$ or supply LOW with a resulting utility measure of $[90{,}000]^{1/2}-0=300>250$. In short, supply of HIGH under this compensation arrangement is not incentive compatible.

Our original analysis, in other words, does not provide a practicable resolution of the labor contracting problem in this setting of self interested behavior coupled with limited observability and verifiability. We seek labor input, but cannot verify its supply. Only labor output, cost and revenue here, is observable and verifiable. Thus, we use the output to infer the input. We evaluate the agent, so to speak, based on his output. In this way output serves two roles: it is a source of *value* in the production process and it is a source of *information* for the control problem of motivating the self interested manager. This gets to the basic question: how should we use the information provided by output; do we want to use cost, revenue, or cost and revenue to evaluate the manager?[8] The question is interesting because the value and information components of the output are not coextensive. We cannot unambiguously infer the one from the other.

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[4] It is efficient to compensate the agent with a constant wage. Otherwise, his payment is at risk while risk is noxious to him but not to the principal.

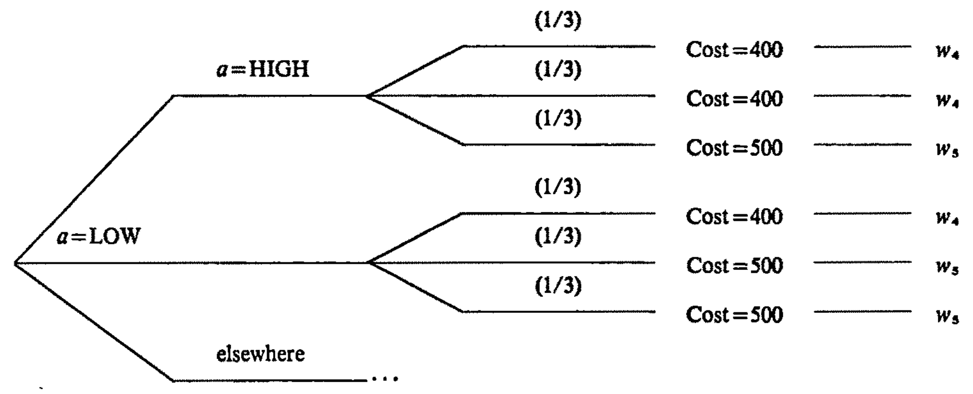
[5] $(1/3)(800)+(2/3)(1000)=933.33$.

[6] $(1/3)(400)+(2/3)(500)=466.67$.

[7] $(2/3)(400)+(1/3)(500)=433.33$.

[8] We sketch the story in terms of cost, revenue, or cost and revenue to provide a caricature of an institutional setting. The typical cost center setting would, however, focus on cost and physical output, as with a flexible budget. So the available information is perhaps better framed in terms of cost, physical output, and revenue rather than cost and revenue. The addition of an explicit output descriptor, though, needlessly complicates our setting. Similar comments apply to variances.

Exhibit 1
Agent's Decision Tree
Cost Observable



Controllability Answer

Consider the controllability prescription. If an output statistic such as revenue is used in the agent's evaluation then the agent should be able to control that statistic. Return to the data in Table 1. The revenue depends on which state nature supplies, but not the labor input. Conversely, the cost depends on both the state and labor. The agent, through conscious behavior, can influence the cost probability or lottery. The revenue probability or lottery is totally independent of what the agent does. We conclude, using this notion of controllability, our particular agent is best evaluated as the head of a cost center. He controls cost, but not revenue.

Model's Answer

Now ask the agency model the same question. First, suppose we observe only the cost outcome. What is the best way to contract for supply of HIGH? The trick is to design the agent's decision tree so his self interested behavior mirrors the principal's wishes. Let w_4 denote the agent's wage if cost $=400$ is realized and w_5 if cost $=500$ is realized. The agent's decision tree is shown in Exhibit 1. Goal congruence demands the agent prefer HIGH to the other options. Thus, we must engineer *the agent's* decision tree so HIGH is preferred. This requires:

$$2/3[w_4]^{1/2}+1/3[w_5]^{1/2}-50\geq 250,$$

and

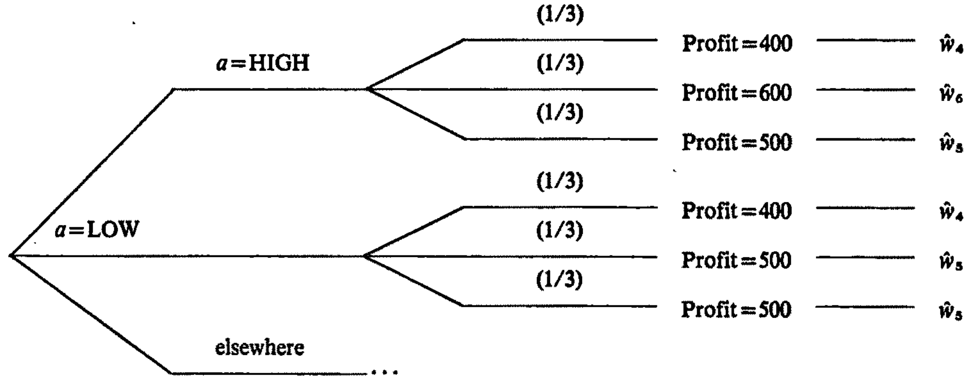
$$2/3[w_4]^{1/2}+1/3[w_5]^{1/2}-50 \geq 1/3[w_4]^{1/2}+2/3[w_5]^{1/2}-0.$$

The first inequality forces HIGH to be as good as "go elsewhere...." The second forces HIGH to be as good as LOW. In this way self interest on the agent's part leads to choice of HIGH. Goal congruence is a constraint in designing the control system. We design the system so the preferred behavior is in the agent's self interest.

But achieving goal congruence is only part of the principal's problem. Another concern is the cost of aligning the agent's behavior. Naturally, the principal will select the $w_4 \backslash w_5$ combination that is least expensive. With the principal risk

EXHIBIT 2

AGENT'S DECISION TREE
REVENUE AND COST OBSERVABLE



neutral, least expensive means least expected payment to the agent when he is motivated to supply HIGH. The best combination is, therefore, located by the following program:

$$\min_{w_4, w_5} \quad 2/3w_4 + 1/3w_5$$

subject to

$$\begin{aligned} &2/3[w_4]^{1/2} + 1/3[w_5]^{1/2} - 50 \geq 250 \\ &2/3[w_4]^{1/2} + 1/3[w_5]^{1/2} - 50 \\ &\quad \geq 1/3[w_4]^{1/2} + 2/3[w_5]^{1/2} - 0 \\ &\quad w_4, w_5 \geq 0. \end{aligned}$$

The solution is $w_4 = 122{,}500$ and $w_5 = 40{,}000$.[9] The principal's evaluation is now:

	Labor Supply	
	LOW	*HIGH*
E(Revenue)	933.33	933.33
Less *E*(Cost)	466.67	433.33
E(Gross profit)	466.67	500.00
Less *E*(Wage)	62.50[10]	95.00[11]
E(Net profit)	404.17	405.00

Contrast this with use of revenue and cost in the agent's evaluation. Recalling

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[9] This solution can be developed in the following intuitive fashion. Suppose only the first constraint is binding. This is the setting where we have to induce the agent to work for the principal, without any concern for selecting HIGH over LOW. With the principal risk neutral intuition correctly suggests $w_4 = w_5 = 90{,}000$. But the second constraint is violated. Conversely, using only the second constraint requires $[w_4]^{1/2} - [w_5]^{1/2} = 150$. Minimizing the expected payment implies $w_5 = 0$ and $w_4 = 22{,}500$, which violates the first constraint. By implication both constraints are binding. Solving two equations in two unknowns provides $[w_4]^{1/2} = 350$ and $[w_5]^{1/2} = 200$, or $w_4 = 122{,}500$ and $w_5 = 40{,}000$.

Alternatively, let $v_4 = [w_4]^{1/2}$ and $v_5 = [w_5]^{1/2}$. Substituting, our program is

$$\min_{v_4, v_5} \quad 2/3v_4^2 + 1/3v_5^2$$

subject to

$$\begin{aligned} &2/3v_4 + 1/3v_5 - 50 \geq 250 \\ &2/3v_4 + 1/3v_5 - 50 \geq 1/3v_4 + 2/3v_5 - 0 \\ &\quad v_4, v_5 \geq 0. \end{aligned}$$

This is a quadratic objective function with linear constraints and can be analyzed with standard optimization routines, such as LINDO. Alternatively, direct numerical methods using standard software packages, such as Borland's Eureka, can be used.

[10] The earlier solution of $w_4 = w_5 = 62{,}500$ satisfies both constraints because there is no lower labor supply than LOW.

[11] $(2/3)(122{,}500) + (1/3)(40{,}000) = 95{,}000$.

the data in Table 1, we see the possible (gross) profit realizations are 400, 500, and 600. Let $\hat{w}_4$ denote the agent's compensation if a profit of 400 is realized, $\hat{w}_5$ if a profit of 500 is realized, and so on. The agent's decision tree is shown in Exhibit 2. Engineering the agent's tree requires

$$1/3[\hat{w}_4]^{1/2}+1/3[\hat{w}_6]^{1/2}+1/3[\hat{w}_5]^{1/2}-50 \geq 250,$$

and

$$1/3[\hat{w}_4]^{1/2}+1/3[\hat{w}_6]^{1/2}+1/3[\hat{w}_5]^{1/2}-50 \geq 1/3[\hat{w}_4]^{1/2}+2/3[\hat{w}_5]^{1/2}-0.$$

The principal's program becomes

$$\min_{\hat{w}_4,\hat{w}_5,\hat{w}_6} \quad 1/3\hat{w}_4+1/3\hat{w}_6+1/3\hat{w}_5$$

subject to

$$1/3[\hat{w}_4]^{1/2}+1/3[\hat{w}_6]^{1/2}+1/3[\hat{w}_5]^{1/2}-50 \geq 250$$

$$1/3[\hat{w}_4]^{1/2}+1/3[\hat{w}_6]^{1/2}+1/3[\hat{w}_5]^{1/2}-50 \geq 1/3[\hat{w}_4]^{1/2}+2/3[\hat{w}_5]^{1/2}-0$$

$$\hat{w}_4,\hat{w}_5,\hat{w}_6 \geq 0.$$

The solution is $\hat{w}_4=90{,}000$, $\hat{w}_5=50{,}625$, $\hat{w}_6=140{,}625$.[12] The principal's evaluation is now:

	Labor Supply	
	LOW	*HIGH*
E(Revenue)	933.33	933.33
Less *E*(Cost)	466.67	433.33
E(Gross profit)	466.67	500.00
Less *E*(Wage)	62.50	93.75[13]
E(Net profit)	404.17	406.25

The principal is strictly better off using cost and revenue, as opposed to just cost, in the agent's evaluation. The agent, however, is indifferent. In either case his expected utility is 250. Revenue is a useful evaluation statistic, despite the controllability-based conclusion it is not controllable and, therefore, useless in the evaluation exercise.[14]

A Second Example

Now consider a slight variation on this example. Everything is identical except the revenue structure is altered in Table 2 (000 omitted).

This makes the revenue lottery dependent on the agent's behavior. So a controllability approach would imply revenue is a useful evaluation statistic because the agent is able to influence which revenue result obtains. Further observe the revenue structure is constructed so a cost realization of 400 always is accompanied by a revenue realization of 1000; and a cost realization of 500 always is accompanied by a revenue realization of 800.[15] Working through

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[12] Some may be troubled by the non-monotonicity of this contract, which calls for a higher payment to the manager for achieving a profit of 400 than a profit of 500. Before concluding this does not accord with schemes in practice, the following reinterpretation should be considered. The manager's contract is equivalent to a salary of 50,625, with a bonus of 39,375 for holding costs to 400. If costs are "controlled" (i.e., held to 400) while revenue is "maintained" at 1000, the bonus is increased to 90,000.

[13] $(1/3)(90{,}000)+(1/3)(50{,}625)+(1/3)(140{,}625)=93{,}750$.

[14] Two important assumptions should be recalled. First we carefully chose an illustration in which the relationship between revenue and cost and revenue less cost is one to one. Otherwise, the precise pair of realizations is important, not just their algebraic difference. Second, we assume the principal is risk neutral. The agent, therefore, has no comparative advantage at carrying risk. If this were not the case we would always prefer a profit center evaluation simply because efficient risk sharing would dictate the principal and agent each have income at risk. Here, however, we focus exclusively on control considerations in examining how best to evaluate the agent. This is accomplished by neutralizing the demand for risk sharing with the agent. See Demski [1976].

[15] This extreme case of a one-to-one association between cost and revenue makes the analysis transparent, but is not necessary for the point to hold. As is discussed later, the important feature is that the *distribution* of revenue conditional on cost does not vary with the agent's behavior. The distinction is one of equivalence in (conditional) distribution, not of "equality" in the guise of a one-to-one association. Of course, the latter implies the former.

TABLE 2
REVENUE, COST, AND GROSS PROFIT FOR EXAMPLE 2

		State		
		s_1	s_2	s_3
LOW Labor Supply:	Revenue	1000	800	800
	Cost, exclusive of labor	400	500	500
	Profit, exclusive of labor cost	600	300	300
HIGH Labor Supply:	Revenue	1000	1000	800
	Cost, exclusive of labor	400	400	500
	Profit, exclusive of labor cost	600	600	300

the details of the agency framework will produce the following conclusions: (1) the principal prefers to implement a HIGH supply of labor; (2) the most efficient contracting arrangement is use of the cost outcome, accompanied by $w_4 = 122{,}500$ and $w_5 = 40{,}000$; and (3) revenue is of no use in evaluating the agent.[16] Thus, we have a case where a controllability focus implies revenue is an important evaluation statistic while an agency analysis implies it is superfluous.

A Third Example

For a final example, change the revenue structure in our setting as described in Table 3 (000 omitted). As in the second example, revenue now depends on the agent's behavior and a controllability focus implies it is best to hold the agent responsible for the cost and revenue (or profit) outcomes. In turn, working through the details of the agency framework reveals: (1) the principal prefers to implement a HIGH supply of labor; and (2) the most efficient contracting arrangement is use of cost and revenue with payment to the agent of $\hat{w} = 0$ when a profit of 200 obtains and $\hat{w} = 90{,}000$ otherwise.

In this setting, a profit of 200 signals unmistakably the agent has supplied LOW. So the contract "penalizes" the maximal amount by paying 0 (dismissal?). This threat allows for an equilibrium payment of 90,000. We, thus, have an illustration where the controllability and agency analyses agree.

II. SOME INTUITION

These examples, taken together, give settings where a non-controllable item is useful, where a controllable item is useless, and where a controllable item is useful. The important question is what explains this schism between the common sense of the controllability notion and the deductive sense of the principal-agent exercise. The answer is to be found in the probabilities of the revenue and cost outcome.

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[16] More precisely, knowledge of cost implies knowledge of revenue and vice versa. So using only cost, using only revenue, or using cost and revenue are identical evaluation schemes. Also notice HIGH is preferred here because we have the same cost structure along with less revenue prospects under LOW.

TABLE 3

REVENUE, COST, AND GROSS PROFIT FOR EXAMPLE 3

		State		
		s_1	s_2	s_3
LOW Labor Supply:	Revenue	800	700	1000
	Cost, exclusive of labor	400	500	500
	Profit, exclusive of labor cost	400	200	500
HIGH Labor Supply:	Revenue	800	1000	1000
	Cost, exclusive of labor	400	400	500
	Profit, exclusive of labor cost	400	600	500

To develop this point, notice the common structure in the above examples centers on two facts: First, there is inherent conflict because the principal wants to implement one labor supply (HIGH) while (other things equal) the agent wants to implement a different labor supply (LOW). Second, informational asymmetry is present since the cost and revenue outcomes do not necessarily reveal exactly what input the agent has supplied. Put differently, the principal seeks input from the agent, but cannot directly observe input. As a result, the parties contract on observable and verifiable output. In short, output is used as an imperfect indicator of input, and the *information content* of output becomes of concern.[17]

Information Content

Information content is a subtle notion in this setting. We use the cost and revenue outcomes as indicators of what input was supplied. In particular, we use the statistical pattern of these outcomes. But since we are concerned about the agent's supply of input, we contrast the statistical pattern under the assumption he supplies the desired input with the statistical pattern under the assumption he supplies some other input.

To develop this theme, we contrast two probability statements: (1) the probability of revenue $=R$ under inputs $a=\text{HIGH}$ and $a=\text{LOW}$; and (2) the probability revenue $=R$ under inputs $a=\text{HIGH}$ and $a=\text{LOW}$ conditioned on cost $=C$. Let $f(R|a)$ denote the probability revenue $=R$ when the agent supplies input $=a$. Also, let $f(R|C,a)$ denote the probability revenue $=R$ when cost $=C$ has been observed and when the agent supplies input $=a$. These probabilities, for the three examples, are displayed in Table 4.[18] Notice, in particular,

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[17] As mentioned earlier, the productive output provides value (here in the sense of profit) and information. In an extended setting, we would then design the productive process to balance these two types of output. As a result, we do not model the setting as one of finding the least costly control system to implement the otherwise most efficient production arrangement. The design problem does not separate.

[18] The easiest way to replicate these calculations is to construct the joint probabilities, $f(R,C|a)$. These are displayed in the Appendix. By the laws of probability, we have $f(C|a)=f(700,C|a)+f(800,C|a)+f(1000,C|a)$ and $f(R|C,a)=f(R,C|a)/f(C|a)$.

TABLE 4
MARGINAL AND CONDITIONAL PROBABILITIES

Example 1

$f(R|a)$

		a=LOW	*a=HIGH*
Revenue	800	1/3	1/3
	1000	2/3	2/3

$f(R|C,a)$

a=LOW
Cost

		400	*500*
Revenue	800	1	0
	1000	0	1

a=HIGH
Cost

		400	*500*
Revenue	800	1/2	0
	1000	1/2	1

Example 2

$f(R|a)$

		a=LOW	*a=HIGH*
Revenue	800	2/3	1/3
	1000	1/3	2/3

$f(R|C,a)$

a=LOW
Cost

		400	*500*
Revenue	800	0	1
	1000	1	0

a=HIGH
Cost

		400	*500*
Revenue	800	0	1
	1000	1	0

the following differences among the three examples:

example one:

$$f(R\,|\,\text{HIGH})=f(R\,|\,\text{LOW}) \text{ and } f(R\,|\,C,\text{HIGH})\neq f(R\,|\,C,\text{LOW})$$

example two:

$$f(R\,|\,\text{HIGH})\neq f(R\,|\,\text{LOW}) \text{ and } f(R\,|\,C,\text{HIGH})=f(R\,|\,C,\text{LOW})$$

example three:

$$f(R\,|\,\text{HIGH})\neq f(R\,|\,\text{LOW}) \text{ and } f(R\,|\,C,\text{HIGH})\neq f(R\,|\,C,\text{LOW}).^{19}$$

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[19] Two other points should be noted. First, an example where revenue is simply noise would provide a setting with $f(R\,|\,\text{HIGH})=f(R\,|\,\text{LOW})$ and $f(R\,|\,C,\text{HIGH})=f(R\,|\,C,\text{LOW})$. Second, there is nothing pathological about the examples. The data for example 2, for instance, exhibit perfect correlation between cost and revenue. But as mentioned in footnote 15, this is done to keep

TABLE 4—*Continued*

Example 3

$f(R|a)$

		a=LOW	a=HIGH
Revenue	700	1/3	0
	800	1/3	1/3
	1000	1/3	2/3

$f(R|C,a)$

a=LOW

		Cost 400	*Cost* 500
Revenue	700	0	1/2
	800	1	0
	1000	0	1/2

a=HIGH

		Cost 400	*Cost* 500
Revenue	700	0	0
	800	1/2	0
	1000	1/2	1

Consider $f(R|a)$, the marginal probability revenue $=R$ under input supply a. $f(R|\text{HIGH} = f(R|\text{LOW})$ in the first example, while $f(R|\text{HIGH}) \neq f(R|\text{LOW})$ in the second and third examples. By conscious choice of input, the agent controls the revenue probabilities (or revenue lottery) in the latter two examples, but not in the first. This is the basis on which we applied the controllability notion.

definition: The agent *controls* revenue if $f(R|a)$ is a nontrivial function of a.

That is, we say the agent controls revenue if he is able to affect the marginal probability of revenue through his behavior (i.e., his supply of labor input).[20]

Now consider the use of revenue (or cost) in the compensation arrangement. We say the parties use the revenue measure if the agent's compensation depends on the actual revenue realization. Let the agent's compensation be denoted $w=I(R,C)$. If revenue of R and cost of C are realized the agent is paid amount $w=I(R,C)$. If for some value of C different values of R lead to different payment amounts, we then say the agent is held responsible for revenue.

definition: The agent is *held responsible* for revenue (cost) under $I(R,C)$ if $I(R,C)$ is a nontrivial function of revenue (cost).[21]

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the illustration uncluttered. Consider a setting where revenue is either 1000 or 800. Let the revenue lottery depend only on cost, and be such that $R=1000$ is more probable with one cost realization than another. This will ensure $f(R|\text{HIGH}) \neq f(R|\text{LOW})$ and $f(R|C,\text{HIGH}) = f(R|C,\text{LOW})$. See the extended example that begins in footnote 26.

[20] A similar statement can be made about controlling cost and $f(C|a)$.

[21] By nontrivial we mean for some value of C, say $\hat{C}$, we have distinct R^1 and R^2 such that $I(R^1,\hat{C}) \neq I(R^2,\hat{C})$.

From here we articulate the controllability notion as saying the agent should be held responsible for revenue if he controls revenue, for cost if he controls cost, and for profit if he controls revenue and cost.[22] By this principle, the agent should be held responsible for cost in each of the three examples, and for revenue (and, therefore, profit) in only the latter two.[23]

Conditional Probabilities

The conclusion above does not agree with the principal-agent solutions, where we find revenue a useful evaluation measure in the first and third examples.[24] This discrepancy arises because information content and controllability are not coextensive. In the second example, for instance, the agent controls revenue, but revenue tells us nothing about the agent's input, provided we already are observing cost. In this case, $f(R|C,a)$ depends only on cost; we may write $f(R|C,a) \equiv f(R|C)$. Given we are already using cost to evaluate the agent, the *conditional* probability of revenue, $f(R|C,a)$, cannot be influenced by the agent.

In contrast, the agent does influence the conditional probability of revenue in the other two examples. $f(R|C,a)$ is a nontrivial function of input a in these two cases. The explanation is, perhaps, more clear if we factor the probability construction:

$$f(R,C|a)=f(R|C,a)f(C|a).$$

If $f(R|C,a)=f(R|C)$, we have a case where the random variation in revenue *that is not explained by cost* cannot be influenced in any way by the agent's behavior. Stated differently, if $f(R|C,a) = f(R|C)$ the random variation in revenue not explained by cost tells us nothing whatever about whether the agent supplied a=LOW or a=HIGH. Given we know cost, revenue has no information content in terms of inferring what the agent supplied. If this is the case, holding the agent responsible for revenue and cost is inefficient. It merely "noises up" the evaluation. Revenue variations are, in the presence of cost, pure noise. This suggests the following:

> *definition*: Revenue has *information content* in the presence of cost if $f(R|C,a)$ is a nontrivial function of a.

To understand this definition, suppose we already know cost and focus on the conditional distribution of revenue, $f(R|C,a)$. If the agent cannot influence this conditional distribution, we say revenue has no information content in the presence of cost. But if the agent can influence this conditional distribution, we say revenue has information content in the presence of cost. Note well, information content is related to our concept of control over revenue. The difference is we now acknowledge the information content of cost. The focus is influence over the distribution of revenue *given*

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[22] Stated differently, the idea is the agent should be held accountable for revenue if he controls revenue. Held accountable, in turn, translates into $I(R,C)$ is a nontrivial function of revenue in this setting.

[23] Observe that the controllability principle can be applied sequentially. If we are considering three variables, say labor cost, raw material cost, and revenue, we can assess whether the manager controls each of these variables without reference to the others. In this way, one form of textbook exercise consists of the specification of the individual's position within the organization and a list of potential performance measures. The student is then asked to proceed down the list and suggest whether each variable is controllable by the identified individual. In this way, the student supposedly identifies the best subset of variables for evaluating the individual in question.

[24] More precisely, we are indifferent between use of revenue or cost in the second example, but strictly prefer use of both variables in the first and third examples. As noted, the second example has a one to one relation between revenue and cost. An expanded version of the example, as sketched in footnote 26, would have cost strictly preferred to revenue, along with revenue being useless in the presence of cost for evaluation purposes.

cost is known. The key is $f(R\,|\,C,a)$, not $f(R\,|\,a)$.

Model Interrogation

This shift in focus has intuitive appeal. Marginal and conditional distributions are not the same, and it seems we should focus on what we learn conditioned on what we are already observing. Moreover, the principal-agent analysis reinforces this intuition.[25]

> *Claim*: Suppose the agent is held responsible for revenue in the optimal solution to the principal-agent problem. Then revenue has information content.

The assertion is nontrivial use of revenue (given cost is being used to evaluate the manager) can only arise in the principal-agent solution if revenue has information content. To explore the formal reasoning, suppose, to the contrary, we have a case where the agent is held responsible for revenue even though $f(R\,|\,C,a)$ does not depend on input a. In our specialized setting, this means we have some $I(R,C)$ compensation scheme that satisfies the following constraints:[26]

$$\Sigma_{R,C}[I(R,C)]^{1/2}f(R,C\,|\,\text{HIGH}) - V(\text{HIGH}) \geq \bar{U},$$

and

$$\Sigma_{R,C}[I(R,C)]^{1/2}f(R,C\,|\,\text{HIGH}) - V(\text{HIGH}) \geq \Sigma_{R,C}[I(R,C)]^{1/2}f(R,C\,|\,\text{LOW}) - V(\text{LOW}).$$

The first constraint, recall, requires the agent weakly prefer accepting the contract terms and supplying HIGH to his other alternative, with a utility value of $\bar{U}$. The second requires the agent weakly prefer accepting the contract terms and supplying HIGH to accepting the contract terms and supplying LOW. Now, since revenue does not have information content in the presence of cost, factoring the probability provides:[27]

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[25] Holmstrom [1979] and Shavell [1979] developed the generic argument that use of a monitor in the principal-agent setting implies the monitor's conditional distribution is a nontrivial function of the agent's input. Subsequent studies, such as Baiman and Demski [1980], Baiman [1982], and Demski and Sappington [1986], have applied it to specific accounting questions. Baiman and Noel [1985] examine a multiperiod setting where noncontrollable capital cost is useful as a proxy for anticipated capacity choices by the principal when the agent is induced to alter his input as a function of this proxy.

Further recall we assume the principal is risk neutral. This means the agent is never used for risk sharing purposes. (By analogy, risk sharing is accomplished in the capital, not the labor, market.) If the principal were also risk averse here, simple risk sharing would dictate the agent always be held responsible for revenue and cost, since profit is at risk.

[26] To illustrate, consider a setting identical to that in our earlier examples, except for the following relationship among states, acts, revenue, and cost (000 omitted):

	s_1	s_2	s_3	s_4	s_5	s_6	s_7
probability	2/16	1/16	2/16	1/16	6/16	2/16	2/16
LOW labor supply:							
Revenue	800	800	800	800	1000	1000	1000
Cost	400	500	500	500	400	500	500
Gross Profit	400	300	300	300	600	500	500
HIGH labor supply:							
Revenue	800	800	800	1000	1000	1000	1000
Cost	400	400	500	400	400	400	500
Gross Profit	400	400	300	600	600	600	500

Further assume the agent is held responsible for revenue and cost under the following $I(R,C)$ payment arrangement:

$$\begin{aligned} I(1000,400) &= 160{,}000,\\ I(1000,500) &= 40{,}000,\\ I(800,400) &= 40{,}000, \text{ and}\\ I(800,500) &= 10{,}000. \end{aligned}$$

This payment arrangement meets the agent's required utility constraint (of 250 utiles). It also induces the agent to supply the HIGH labor input. Using the construction that follows in the text, however, we can show this is a wasteful arrangement because it ties the agent's pay to revenue, which has no information content in the presence of cost. Subsequent notes trace this construction.

[27] In the example in the previous footnote we have:

$$\begin{aligned} &f(800,400\,|\,\text{LOW}) = f(800\,|\,400,\text{LOW})f(400\,|\,\text{LOW}) = (.25)(.50) = .125,\\ &f(800,400\,|\,\text{HIGH}) = f(800\,|\,400,\text{HIGH})f(400\,|\,\text{HIGH}) = (.25)(.75) = .1875,\\ &f(800,500\,|\,\text{LOW}) = f(800\,|\,500,\text{LOW})f(500\,|\,\text{LOW}) = (.50)(.50) = .25, \text{ and}\\ &f(800,500\,|\,\text{HIGH}) = f(800\,|\,500,\text{HIGH})f(500\,|\,\text{HIGH}) = (.50)(.25) = .125. \end{aligned}$$

Note, $f(800\,|\,400,\text{LOW}) = f(800\,|\,400,\text{HIGH}) = .25$ and

$$\begin{aligned} f(R,C|a) &= f(R|C,a)f(C|a) \\ &= f(R|C)f(C|a). \end{aligned}$$

With this factoring, we rewrite the constraints as follows:

$$\Sigma_{R,C}\{[I(R,C)]^{1/2} f(R|C)\} f(C|\text{HIGH}) - V(\text{HIGH}) \geq \bar{U},$$

and

$$\begin{aligned} &\Sigma_{R,C}\{[I(R,C)]^{1/2} f(R|C)\} f(C|\text{HIGH}) - V(\text{HIGH}) \\ &\geq \Sigma_{R,C}\{[I(R,C)]^{1/2} f(R|C)\} f(C|\text{LOW}) - V(\text{LOW}). \end{aligned}$$

Each term enclosed within the $\{\bullet\}$ brackets is identical. This allows us to express the constraints in the following fashion:[28]

$$\Sigma_C\{\Sigma_R[I(R,C)]^{1/2} f(R|C)\} f(C|\text{HIGH}) - V(\text{HIGH}) \geq \bar{U},$$

and

$$\begin{aligned} &\Sigma_C\{\Sigma_R[I(R,C)]^{1/2} f(R|C)\} f(C|\text{HIGH}) - V(\text{HIGH}) \\ &\geq \Sigma_C\{\Sigma_R[I(R,C)]^{1/2} f(R|C)\} f(C|\text{LOW}) - V(\text{LOW}). \end{aligned}$$

From here we replace the common term with a payment that depends only on cost:[29]

$$\Sigma_R[I(R,C)]^{1/2} f(R|C) \equiv [\hat{I}(C)]^{1/2}.$$

$\hat{I}(C)$ is that payment the agent would gladly exchange for the $I(R,C)$ lottery. Since the agent is held responsible for revenue, we know $I(R,C)$ is a nontrivial function of R. But $\hat{I}(C)$ does not depend on R. For each cost realization, the agent is indifferent between receiving $\hat{I}(C)$ for certain or engaging in the nontrivial $I(R,C)$ compensation lottery. But since the agent is strictly risk averse, he is willing to pay a premium to unburden himself of this revenue risk:

$$\Sigma_R I(R,C) f(R|C) > \hat{I}(C).$$

In this way, the principal is able to replace $I(R,C)$ with $\hat{I}(C)$. This replacement does not hold the agent responsible for revenue, has lower expected cost to the principal, delivers the same expected utility to the agent, and induces the agent to supply HIGH.[30] Put another way, the $\hat{I}(C)$ construction is possible because we are "filtering out" needless noise in the evaluation process.

From Controllability to Information Content

Thus, any solution that holds the agent responsible for revenue when revenue has no information content in the presence of cost can be improved. The key

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$f(800|500,\text{LOW}) = f(800|500,\text{HIGH}) = .50$. We also have $f(1000|\text{LOW}) = 10/16$ and $f(1000|\text{HIGH}) = 11/16$.

[28] In the continuing example, these constraints become:

$$\{400(3/4)+200(1/4)\}(3/4)+\{200(1/2)+100(1/2)\}(1/4) - 50 \geq 250,$$

and

$$\begin{aligned} &\{400(3/4)+200(1/4)\}(3/4)+\{200(1/2)+100(1/2)\}(1/4) \\ &-50 \geq \{400(3/4)+200(1/4)\}(1/2)+\{200(1/2) \\ &+100(1/2)\}(1/2) - 0. \end{aligned}$$

[29] Continuing the example, we have the following constructions:

$$[400(3/4)+200(1/4)] = 350 = [\hat{I}(400)]^{1/2}, \quad \text{or } \hat{I}(400) = 122{,}500;$$

and

$$[200(1/2)+100(1/2)] = 150 = [\hat{I}(500)]^{1/2}, \quad \text{or } \hat{I}(500) = 22{,}500.$$

This is, in fact, the optimal payment schedule to motivate choice of HIGH in this example. It has an expected labor cost of 97,500. In contrast, the original $I(R,C)$ arrangement has an expected labor cost of 103,750.

[30] By construction we have:

$$\begin{aligned} &\Sigma_{R,C}[I(R,C)]^{1/2} f(R,C|\text{HIGH}) - V(\text{HIGH}) \\ &\equiv \Sigma_C[\hat{I}(C)]^{1/2} f(C|\text{HIGH}) - V(\text{HIGH}) \geq \bar{U}, \end{aligned}$$

and

$$\begin{aligned} &\Sigma_{R,C}[I(R,C)]^{1/2} f(R,C|\text{HIGH}) - V(\text{HIGH}) \\ &\equiv \Sigma_C[\hat{I}(C)]^{1/2} f(C|\text{HIGH}) - V(\text{HIGH}) \\ &\geq \Sigma_{R,C}\{[I(R,C)]^{1/2} f(R|C)\} f(R|\text{LOW}) - V(\text{LOW}) \\ &\equiv \Sigma_C[\hat{I}(C)]^{1/2} f(C|\text{LOW}) - V(\text{LOW}). \end{aligned}$$

insight is we use the agent's output (revenue and cost here) to infer his input. This inferential exercise compares the statistical properties of the agent's input when he supplies the desired input with those that arise when he supplies some alternative input. Given cost is already observed, an informative revenue output means the (conditional) statistical properties differ according to the agent's behavior. But an uninformative revenue output means the (conditional) statistical properties are independent of the agent's behavior. Holding the agent responsible for revenue in such a case has no effect other than making his compensation subject to purely random noise. In other words, the information content of revenue is signaled by the conditional probability being controllable. Use of an uninformative output statistic merely subjects the agent to noise. The definition of information content tells us precisely when we would want to "filter out" this noise in the agent's evaluation.

In this manner we conclude from the principal-agent analysis that any use of revenue in the agent's evaluation implies revenue has information content in the presence of cost. Conversely, with additional regularity assumptions (as in Holmstrom [1982] or Demski and Sappington [1986]), we could provide a setting where information content of revenue necessarily implies the agent should be held responsible for revenue. The important message, though, is no use of revenue is called for by the model unless revenue has information content in the presence of cost.

The intuition for this conclusion parallels that for the original controllability notion. The single variation in the logic is to take account of what other information we already are observing. The key, in other words, is to define controllability in terms of the conditional probability of the output statistic, thereby taking account of the available information.

III. Application

Stepping back from the examples and analysis somewhat, we are focusing on a setting where a list of performance variables is present and asking which elements on the list should be used in evaluating the manager (or agent) in question. Applying the controllability notion, we are led to a focus on marginal probabilities. Can the manager, through action, control the probability distribution of the variable in question. If so, the manager should be held responsible for that variable. Control begets responsibility in this framework.

Adopting a more explicit information perspective, we ask what it is the manager is supposed to be doing and why we want to evaluate his performance. Moving to an agency setting, the answers are the manager is to supply personally costly labor inputs, the supply of this input is not observable, and we must use output (including the output of various performance statistics) as a noisy indicator of input. This allows us to be precise about the information content of an evaluation measure. The key principle turns out to be information content, a close cousin of controllability but one that adjusts for what other information is already being used. Controllability does not imply information content and information content does not imply controllability.

Going still further, we now ask whether this insight of distinguishing controllability and information content helps us solve or understand real problems as opposed to numerical examples. This is not an easy task, because the information perspective demands we think in terms of probabilities and take explicit account of what other information is being processed.

A ready illustration is provided by tournaments. Familiar examples are sports bonus clauses (e.g., for achieving some type of all-star status) and sales contests (e.g., sales person of the year recognition).[31] Grading on a curve is a common practice. Relative performance evaluation of high level executives, where compensation depends on performance relative to that of a peer (e.g., industry) group, is another illustration. In each case a primary consideration in the agent's evaluation is performance of a peer agent. When viewed from a controllability perspective this is perplexing. The agent in question has no control over the performance of the peer. When viewed from an information content perspective, this practice is far from perplexing. It is easy to imagine performance of another agent in similar circumstances could possess information content.[32] Each agent's performance is affected by the common environment. The peer's performance tells us something about that environment and, thus, indirectly something about the performance of the agent in question.

Suppose two students take a common examination. The second student's score tells us nothing about the first student's performance. But the second student's score in conjunction with the first student's score typically does, by indirectly telling us something about the common environment. For the sake of argument, suppose the score of student i is determined by

$$score_i = effort_i + noise_i + instrument$$

where $effort_i$ is the effort of the student in question, $noise_i$ is randomness in the examination environment that is idiosyncratic to our student, and *instrument* is randomness associated with the examination instrument. Clearly, student $i=1$ cannot control $score_2$. But $score_1 - score_2$ is an interesting statistic, because the instrument randomness has been factored out. In this way, $score_2$ becomes useful in the evaluation of student $i=1$, given we already know $score_1$.[33]

As another illustration, suppose we have two agents, each working in the environment described by Table 1. One agent's output tells us something about the state and, therefore, something about the other's environment and, indirectly, something about the other's input. In fact, agents working in perfectly correlated environments, an admitted extreme, is a case where one agent's output is unusually informative about the other agent, given we know that agent's output.

IV. CONCLUSIONS

This paper offers a refined version of the controllability principle. The argument rests on the assumption managerial evaluation is aimed at producing information that reports on the managerial services or inputs supplied. If the manager can affect the statistical pattern of some particular variable, the manager controls that variable. If the manager can affect the statistical pattern conditioned on whatever else we know, the variable carries information content about the manager's behavior. The concept of information content falls out of a principal-agent analysis as being a central feature of valuable monitoring or evaluation information. In this sense, we offer the information content perspective as a refined version of the controllability principle. Whether the manager controls the variable in question is immaterial. Whether the manager controls (or influences) the variable in question, conditioned on whatever other information is present, is the key notion. That is, information content is a precisely defined controllability notion that accounts for other sources of information.

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[31] Halberstam [1986] describes extensive use of sales contests in the domestic automobile industry.

[32] Baiman and Demski [1980] and Holmstrom [1982] formalize this intuition in a principal-agent setting. Dye [1984] provides a general discussion of problems generated by tournaments. Antle and Smith [1986] provides an empirical investigation, based on high level executive compensation practices.

[33] This vignette hints that an extension of our argument would have the agent's labor supply more generally characterized in terms of quantity and quality. Alternatively, in this particular setting the student's performance would depend on effort, skill, and luck. We then proceed as before, but in a manner aimed at information content with respect to quantity and quality of input, as opposed to quantity of input.

The darker side to this refined principle is the added demand it places on the identification of a control problem. With the traditional controllability notion, we need only ask whether the manager can control the variable in question. With the conditional or information content notion, we must first specify what other information is being used in the evaluation process. Once this source of information is accounted for, we ask whether any new information is produced by the variable in question.[34] This manifests itself in the manager's conditional control of the variable in question.

In short, we find the intuition of the information content perspective appealing, but we also recognize assessing information content is likely to be a difficult task.

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[34] Recent field studies by Merchant [1987] and Dent [1987] illustrate this difficulty. Each study reports violations of the controllability principle. This is accomplished by documentation of various uncontrollable phenomena that are used in the evaluation process. In contrast, the information content perspective is not so amenable to investigation. It demands assessing information content in light of all information being used in the evaluation process. The field investigator's task is dramatically complicated by the importance of identifying the conditioning information.

APPENDIX

JOINT PROBABILITIES
$f(R,C|a)$

Example 1

a=LOW
Cost

		400	500
Revenue	800	1/3	0
	1000	0	2/3

a=HIGH
Cost

		400	500
Revenue	800	1/3	0
	1000	1/3	1/3

Example 2

a=LOW
Cost

		400	500
Revenue	800	0	2/3
	1000	1/3	0

a=HIGH
Cost

		400	500
Revenue	800	0	1/3
	1000	2/3	0

Example 3

a=LOW
Cost

		400	500
Revenue	700	0	1/3
	800	1/3	0
	1000	0	1/3

a=HIGH
Cost

		400	500
Revenue	700	0	0
	800	1/3	0
	1000	1/3	1/3

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Richard P. Brief, 520 Tisch Hall, 40 W. 4th St., Schools of Business, New York University, New York, NY 10003.

A. A. ATKINSON, *Intra-firm Cost and Resource Allocations: Theory and Practice*, Studies in Canadian Accounting Research (Toronto: The Canadian Academic Accounting Association, 1987, pp. 201, Can. $25.00 paper).

As the title implies, this monograph deals with practical as well as theoretical issues in cost allocation and transfer pricing. The early chapters describe actual practice and identify problematic areas from the practitioner's perspective. The remainder of the book wrestles with the lack of theoretical justification for allocation and transfer pricing policies commonly found in practice, and attempts to identify economic and motivational justifications in a real world setting.

Much of the descriptive material is found in Chapters 3 and 4. Chapter 3 describes the results of a questionnaire sent to the largest public Canadian companies. Although limited (the questionnaire takes four minutes to complete), the questionnaire establishes that cost allocation and transfer pricing is common practice and is motivated by a variety of reasons. Ten hypothetical scenarios submitted by respondents appear in this chapter also. These scenarios illustrate unresolved allocation problems, dealing mostly with dysfunctional effects of allocations when the relationship between cost and usage is not clear. Chapter 4 describes allocation practice at six companies. The problems described uncover nothing particularly new—measurement of performance when uncontrollable environmental changes take place, dysfunctional behavior caused by failure to assign the opportunity costs of carrying inventory, motivation against replacing equipment due to short-term reduction in divisional profit—but the material does provide effective illustrations of the usual textbook treatment of these issues.

The theoretical treatment begins in Chapter 2 with a brief review of the allocation literature. Although details are lacking, this section touches on perspectives from a wide range of literature, from economics to psychology. The point here is that the academic literature has not adequately explained pervasive allocation in practice because it has not addressed the environmental complexities and conflicting motivations which exist in the real world. Chapters 5, 6, and 8 provide rational justifications for allocation in this setting. Chapter 5 deals with a central service used by independent decision makers. Through an analysis of economic behavior, the conclusion is that a cost center approach with allocation of capacity costs based on the familiar dual rates (variable costs as a function of usage and capacity costs as a function of planned capacity) leads to more optimal decisions with respect to capacity and usage. Chapter 6 identifies motivational benefits of these dual rates. In Chapter 8 the use of shadow prices in an LP model illustrates a potentially feasible application of opportunity cost pricing.

Two chapters deal with issues in divisional performance measurement. Chapter 7 identifies dysfunctional behavior connected with rewards based on divisional performance. Chapter 9 identifies a rationale for rewarding individual performance as an assessment of skill, but shows that compensation to motivate cooperation and unbiased reporting of divisional opportunities conflicts with compensation to assess skill and reduce shirking.

The survey and case information in this monograph illustrate some typical difficulties with divisional evaluation when common costs exist. The theoretical analysis provides insights into allocation as a response to an imperfect environment. The shadow pricing material offers few new insights and has limited applicability, and the divisional performance discussion in Chapters 7 and 9 has only marginal relevance to allocation issues. However, the monograph provides an excellent overview treatment of cost allocation, coupled with economic justification for the existence of allocations in the real business environment. As such, it could be used as supplementary reading in management accounting or planning and control courses, and would be a useful addition to the library of anyone who is managerially inclined.

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Ronald A. Berk, Editor, *Performance Assessment* (Baltimore: The Johns Hopkins University Press, 1986, pp. xv, 544, $47.50 cloth).

Berk's *Performance Assessment* is a handbook designed with the dual purpose of evaluating the current state and recommending potential changes in the performance assessment of employees and students. To achieve these objectives the book is divided into two distinct sections, a review of methodological issues and an examination of method applications. The book is not addressed to an accounting audience and its contents are not directly related to central accounting issues. Human resource professionals constitute the target market. Thus, the focus of my review will be primarily to acquaint the reader with the book's contents as opposed to a critical evaluation.

The first section, Methods and Methodological Issues, reviews the procedures followed in conducting a performance assessment and also discusses key methodological issues. The topics are covered in a sequential manner consistent with important steps in the performance assessment process. The crucial components of a performance assessment are addressed along with the most prevalent problems and technical issues faced in planning and implementing the assessment.

The first five chapters address the following three questions: What is being measured?; Who should conduct the measurement?; and How should the domain be measured? Measurement tools covered include job analysis, numerical rating scales, behavioral-based rating scales, performance tests, and assessment centers. Under job analysis a review is undertaken of three popular approaches: task-based, attribute-based, and behavior-based. Then the idea of functional job analysis, with its conceptualization of three types of skills, functional, specific content, and adaptive, is proposed as being effective for selection and training. For numerical rating scales, the following four formats for performance evaluation are compared and contrasted: ranking, pair wise comparisons, graphic rating scales, and mixed standard scales. The problems of rater acceptance, psychometric precision, and information availability are also evaluated.

Three behavior-oriented rating scales are reviewed: behaviorally anchored rating scales (BARS), behavior summary scales (BSS), and behavior observation scales (BOS). The advantages and disadvantages of each scale are also discussed. Using a similar format, two types of performance testing, work sample tests and miniature job training, and evaluation tests, are critiqued. In addition, an approach for developing performance tests is presented including both sample procedural analyses and scoring checklists.

Finally, assessment centers for selection of managers and supervisors are analyzed. Included is a list of potential assessment center exercises and a discussion of selecting the proper exercises within the purpose of the assessment center. Two major recommendations made are that multiple assessment techniques should be used when possible, and that assessment should be made on clearly defined dimensions of behavior.

The following four chapters (6–9) present strategies for using the data gathered from these measurement tools. Chapter 6 details methods for discussing assessment results with the assessee, with recommendations for the manager to follow before, during, and after the assessment interview in order to maximize its effectiveness in motivating employees. Chapter 7 covers value judgments in the decision-making process and how the judgments should be weighed. This chapter reviews various utility models, displays empirical research on the models, addresses their pros and cons, and recommends further research in utility analysis, especially in the area of estimating variable costs.

Chapter 8 discusses the technical validity considerations necessary to gauge the value of predictor and criterion measures for personnel decisions. The various analytical procedures used in validity generalization are summarized and critiqued. Results of this comparison show that much of the observed variability of validity coefficients in all of the studies can be attributed to sampling error. Chapter 9 derives a new quantitative performance appraisal system from a comprehensive model of performance and its measurement. The derived performance distribution assessment consists of five tasks to be performed by both rater and ratees, along with a scoring procedure. No results are reported.

The second section, Applications, examines how the methods described in the first section have been implemented into various performance assessment applications and describes future directions and needs within each of the application models used in business and industry. Topics covered include:

- performance appraisal system—a diagnostic model of the appraisal system is introduced along with procedures to be used when following the model and an example of the development of performance measures.
- job evaluation—listed are several approaches for determining the internal value of a position to a firm, including benchmark comparison, grade standards, and factor methods.
- personnel evaluation—deals with measuring the effectiveness of job-related behavior. It is recommended that future research focus on methods for obtaining relevant information.
- technical and mechanical job performance appraisal—here the point is made that different appraisal systems are appropriate under differing job requirements.
- managerial performance appraisal—considers two problems in evaluating managers: how to measure performance and how to determine the proper standards for performance.
- clinical performance appraisal in medicine and law—examines various evaluation techniques, including short answer exams, oral exams, faculty observation, and simulation patients, unique to these two fields.

The final four chapters deal with assessment in an educational environment. For teachers, the who, what, why, and how of evaluation is discussed, along with the presentation of the Redfern model and the Teacher Performance Evaluation model. Under student evaluation, four methods of testing are examined: teacher-made objective tests, published tests, structured performance assessment, and spontaneous performance assessment. The role of performance assessment in the classroom is also examined. Methods for evaluating writing skills, listening skills, and speaking skills are reviewed.

In addition to the two sections on Methods and Applications, the introduction provides a review and discussion of the technical and legal standards that affect performance assessment.

Although lacking in specific recommendations and research findings, *Performance Assessment*, through its sequential coverage of methodological issues and applications, provides the reader with a logically arranged and usable handbook of the current state of the performance assessment field.

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GERMAIN BÖER, *Classifying and Coding for Accounting Operations* (Montvale, NJ: National Association of Accountants, 1987, pp. vii, 49, $7.95).

GERMAIN BÖER, *Decision Support Systems for Management Accountants* (Montvale, NJ: National Association of Accountants, 1987, pp. viii, 49, $7.95).

The stated purpose of *Decision Support Systems for Management Accountants* (DSSMA) is to provide management accountants unfamiliar with decision support systems "a summary of the major ideas on decision support systems (DSS) that have appeared in the literature and business practice" (DSSMA, p. 3). The monograph accomplishes that goal. The monograph provides a literature review supported with examples. The examples are from the literature and the five firms that were visited as part of the research effort. The firms were selected for study because they had reputations for using DSS extensively and they are a rich base from which to draw examples.

Böer describes DSS from a variety of viewpoints and shows that there is more than one definition of what constitutes a decision support system. The discussion of the major components of DSS in Chapter 3 and the discussion of the different characteristics of financial planning models (e.g., IFPS, Interactive Financial Planning System) and spread sheet models (e.g., LOTUS) in Chapter 4 should prove to be particularly useful to the reader. A particularly appealing aspect of the discussion in Chapter 4 is that it discusses fundamental differences of the software. It does not provide a detailed description of the commercial products available. This approach allows the reader to understand the basic difference between financial planning and spread sheet models without the risk of getting lost in technical detail. The monograph should be useful to students and management accountants who need a brief non-technical introduction to DSS.

The purpose of *Classifying and Coding for Accounting Operations* (CCAO) is to summarize the results of a multi-firm study which investigated how accountants and managers take advantage of current information processing technology for the classifying and coding of data (CCAO, p. 2). The monograph presents a worthwhile discussion of the fundamentals of classification and coding applicable to accounts, materials, products, or equipment. Classification and coding methods are described and discussed, along with practical considerations for the design of a useful and efficient coding system.

There are good examples of cost savings resulting from well designed coding systems. For example, by analyzing the data in its material coding system one firm was able to reduce the number of different items stocked for one group of products by 92 percent. Böer discusses studies conducted by at least one of the firms that attempted to provide an understanding of how individuals use and react to various coding structures. Specific recommendations based upon the studies are presented but the design or execution of the studies is not discussed. The reader is not given information to evaluate the validity or generalizability of the studies.

Böer derives principles for the design of codes from the experience of the companies and published materials. However, he does not provide specific citations for the published materials (c.f., page 68 of CCAO—the discussion of standard codes). He does state that "practical knowledge of a number of companies" (CCAO, p. 3) was the primary source of data for the monograph. The principles presented would be easier to evaluate if the sources alluded to had been specifically cited.

In addition, the monograph does not give the reader a clear understanding of how the 12 firms included in the study have taken advantage of information processing technology in conjunction with their classifying and coding of data. Nevertheless, the monograph should be useful as a reference for the fundamentals of classification and coding systems for accounts, materials, products, or equipment.

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William S. Bruns, Jr., and Robert S. Kaplan, Editors, *Accounting and Management: Field Study Perspective* (Boston: Harvard Business School Press, 1987, pp. ix, 374, $35.00).

This book contains 13 papers which give a "field study perspective" on four themes. In Chapter 1, on the theme of adapting to change, Hertenstein describes how six companies used inflation adjusted data for managerial decisions. Hertenstein reports that "With the adoption of inflation accounting, the top managers expected operating managers to dispose of excess assets, improve asset management, accomplish cost reduction, increase prices, improve productivity, and eliminate unprofitable lines" (p. 32). But inflation was high throughout the 1970s and only a handful of companies in the U.S. (fewer than a dozen) had adopted inflation-adjusted accounting (p. 8). Moreover, only three of the six companies in the sample continue to use this methodology. Many other successful companies must have dealt with inflation differently; i.e., used other than FASB-33 type data. The merits of using aggregate data, which is oriented to external users, by these six companies for internal decisions were not addressed.

Many of the essays in this book seem to report the beliefs of company management at face value with little critical evaluation. While such an approach is relevant for preparing cases for pedagogical use, the views of management may not coincide with researchers as disinterested parties. Dent (p. 126) in a later essay observes that "extensive exposure to the research setting is necessary so that the researcher may develop an empathy with people in the organization," which is an approach that bears the risk of diluting field researchers' objective appraisal of issues.

In Chapter 2 Johnson reports on managing overhead at Weyerhauser. Using information from a previously published article which he wrote with a Weyerhauser executive, statements made in annual reports and news conferences, and interviews between Weyerhauser executives and other Harvard case writers, Johnson reports on the "charge-back" system. But it is not entirely clear what Weyerhauser did. Nor is it possible to evaluate the assertion that the charge-back system helps Weyerhauser to capture economies-of-scale and economies-of-scope, or to monitor opportunity costs (p. 64 and p. 66). While the resemblance of the charge-back system to more traditional allocation procedures is considered deceptive (p. 50), the discussion supporting that consideration is not convincing.

In Chapter 3, Palepu reports on interviews with managers at Harnischfeger Corporation about their motivation for changing several accounting methods in 1984. The stated reason, which was comparability with other firms in the industry (pp. 87–89), is questionable. The company's violation of debt covenants in 1982 was followed by an extensive and "traumatic" (p. 82) debt restructuring in 1983; yet the author concludes that the covenant restrictions played "only a minor role in the company's accounting policy decisions" (p. 90). While it is true that the accounting policy was established by a new management, these changes accounted for almost all the profits reported in 1984 (p. 84). Thus, it is difficult to substantiate the conclusion that comparability was the main motivation for the adoption of these methods.

The next three chapters address the theme of designing new information and control systems. In Chapter 4, Bruns reports on a field study to change an embedded (deeply rooted) cost accounting system in a division of a large company which had a poor accounting system and was not well managed. All that seems to have been needed for remedies at the Baker Division was a plan to implement a good old-fashioned cost accounting system. In fact, Bruns quotes the 1957 controllership study by Simon et al. to provide support for the "new" system.

In Chapter 5, Dent reports on the design of a control system at Eurocorp and elaborates on the philosophy calling for de-emphasizing classical bureaucratic principles and encouraging individuals and organizations "to experiment, to be skeptical, to act on intuition, and to pursue incompatible goals" (p. 120). Dent emphasizes contingency approaches.

> When situational variables take on the characteristics described above, theory predicts organizations will experience difficulty in designing formal control systems....At the same time, degrees of confusion and ambiguity may be needed to foment organic dialogue, mutual adjustment, and adaptation. (p. 124)

Under discussion is Eurocorp's Cube system, "whereby costs, revenues, and profits can be extracted in different ways" (p. 129). However, the case does not lead to an appreciation of what the Cube system really does. While Dent emphasizes the system's "more fluid process" and "informal communication," some of the quoted interviews seem to confuse structure with rigidity and planning with perfect foresight (p. 131). The side effects of the Cube system are inefficiency, frustration, and stress (p. 135), and the creation of conditions where managers may pressure divisions over which they have no control (p. 134). Might this stress and inefficiency be at least partly a consequence of the fluid organizational design? It is not surprising then that the "controllability principle is rarely applied" at Eurocorp (p. 133), but Dent concludes that: "It is not obvious, however, that the alternatives [to ambiguity and confusion] would be any less inefficient" (p. 139).

In the last chapter on this theme, Schreuder describes the failure to design a management information system at Volvo Car B. V. in the Netherlands where he was a member of one of the committees that looked at the system. While his presentation describes a troubled company with an ambiguous organizational control system, Schreuder points to the resistance to change and managers' attitudes as reasons for the failure (e.g., p. 160). He does not connect the Dutch government's subsidy of the company with up to (U.S.) $240 million over a two-year period (p. 149) with the lack of managerial incentives to tighten control.

The third theme, new directions, includes Chapter 7 by Banker and Datar providing an illustration of measuring labor productivity and Data Envelope Analysis; Chapter 8 by Cooper and Kaplan on how cost accounting distorts product costs; Chapter 9 by Patell on applying Just-In-Time system at a division at Hewlett-Packard; and Chapter 10 by Zimmerman on lot-sizing decision. The fourth and last theme, measuring management performance, consists of Chapter 11 by Maher on the use of relative performance evaluation; Chapter 12 by Merchant on disregarding the controllability principle; and Chapter 13 on planning, control, and uncertainty by Simons.

In the introduction Bruns and Kaplan advocate field studies for their relevance and generalizability; they state that field methods are low on internal validity but are high on external validity (p. 3). It is difficult to see how field studies based on one or even several conveniently selected companies can be high on external validity (generalization), especially since the editors themselves recognize that "field research may be difficult, if not impossible, to replicate" (p. 13). They also note that "Relying on interviews, with their potential for selectivity and bias, represents an important limitation of field studies" (p. 12).

The relevance of these case studies to the specific real-life setting being looked at is clear, but the claim of external validity is more debatable. Indeed, Dent and others warn against generalizability since the "data relate to only one organization" (p. 143). Field studies are, as Schreuder notes, more useful in hypothesis generation and development of ideas, which is an acceptable feature of naturalistic research. However, field research and more conventional academic research methods are not mutually exclusive. While this book makes a contribution to the developing field research method in accounting, more good research is needed using all approaches.

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Julie H. Hertenstein, *FMC Corporation's Use of Current Cost Accounting* (Montvale, NJ: National Association of Accountants, 1988, pp. ix, 88, $13.95 paper).

This monograph examines the successful implementation of a current cost accounting (CCA) system by the FMC Corporation. The background, technical details, process of implementation, and effects of the CCA system are presented to the reader. The research methodology consisted of a descriptive case study, in which data were obtained primarily through interviews and a review of internal and external documents. The research was conducted from 1983–1986, a period of moderate inflation.

Chapter 2 answers the rhetorical question: Why did the FMC Corporation implement a CCA system? The chapter discusses the historical evolution of the company and analyzes the diverse industry segments which comprise the firm. This chapter also documents top management's dissatisfaction with the existing historical cost measures for internal decisions, especially for strategic planning and resource allocation purposes. Top management concluded that historical cost measures: (1) overstate economic operating performance (2) do not provide operating managers with incentives to make decisions consistent with the goal of increasing shareholder wealth, and (3) are not comparable across diverse industry segments.

The technical details of the CCA system, as it existed in 1986, are presented in Chapter 3. The predominant measurement attribute was current cost "replacement-in-kind" or reproduction cost. The accounting elements adjusted to reflect this measurement attribute included inventory, cost of goods sold, fixed assets, and depreciation. These adjusted accounting elements were used to calculate two measures of performance: current costs return on capital employed (CCROCE) and net contribution. CCROCE was considered particularly important in determining superior or inferior performance with respect to the earnings goal. Net contribution was viewed as a useful indicator of incremental improvement in profitability and capital utilization over time. The internal management systems affected by the CCA data were the annual budget, quarterly forecasts, monthly actual results, monthly management reviews of performance versus targets, and incentive compensation plans. In summary, CCA was the *primary* internal system of measurement at the FMC Corporation by 1985, despite moderate inflation at that time.

Chapter 4 describes the evolutionary process of implementing CCA as the primary internal system of measurement at the FMC Corporation. An *Implementation Time Line* (Exhibit 4) portrays the progress from an embryonic discussion stage in 1977 to its official adoption in 1985. The salient characteristics of the implementational process include: (1) specific goals for the CCA data, (2) widespread top management support for the new measurement system, and (3) resolution of measurement problems at the operating levels.

The corporate effects of implementing the CCA system are discussed in Chapter 5. FMC management concluded that the CCA system had facilitated the accomplishment of the following goals:

- Production assets have been reviewed in order to identify those that were technologically outmoded.
- Low-return product lines have been carefully reviewed to ensure that their benefits to FMC justify the value of the assets committed to them.
- Excess capacity that is not required to support anticipated growth has been eliminated.
- Improved inventory management systems have been installed.

This monograph is an important contribution to the "changing prices" literature. The Financial Accounting Standards Board (FASB), in 1986, rescinded the requirement for supplemental CCA, citing prior research that CCA data were not useful. In contrast, the research contained in this monograph suggests that CCA data may be useful for both external and internal purposes.

For example, FMC managers viewed the relative stock price increase during the tenure of the CCA system as casual (not causal) support for their belief that the actions encouraged by the CCA system increased shareholder wealth. In addition, they concluded that the CCA system improved the comparability of measures for both long term planning and resource allocation purposes (a positive economic effect) and also influenced the motivation of operating managers (a behavioral effect).

The monograph, however, does possess several limitations. First, the literature review does not contain the analytical and empirical research results on measurement error in CCA data published during 1982–1987. Second, the results are situation-specific to FMC. Finally, the effects of other internal factors and external factors cannot be separated from the effects of the CCA system when assessing FMC's performance record over the years.

However, the contributions of this monograph exceed these limitations. Thus, the monograph is recommended for management accountants, auditors, users, policy makers, and researchers interested in the accounting for changing prices.

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ROBIN M. HOGARTH and MELVIN W. REDER, Editors, *Rational Choice* (Chicago and London: University of Chicago Press, 1987, pp. ix, 322, $15.00 paper, $30.00 cloth).

This book contains the proceedings of the Conference on Behavioral Foundations of Economic Theory at the University of Chicago, October 1985. Previously published as a supplement to the October 1986 issue of *The Journal of Business*, the papers were intended to address the significance of recent research which has shown systematic differences between the actual decision behavior of individuals and the behavior posited by the rationality hypotheses underlying contemporary models in economics and finance. The list of contributors is impressive, including two Nobel Laureates and some of the leading scholars in psychology, economics, and finance. Although the editors characterize the conference as a conflict between economists and psychologists, it is more correctly a conflict between rationalists and behavioralists (some of whom are economists).

Following an introduction by Hogarth and Reder, which does a good job of outlining the key issues addressed by the participants, the remainder of the collection is organized along the lines of the four major sessions of the conference. This organization does not really capture the essence of the thematic conflicts of the conference and I found it easier to try to place participants along some challenger-defender continuum.

Ardent challenges to the rationalists include Herbert Simon's familiar observation that assumptions of utility maximization are insufficient to support the conclusions of neoclassical economic analysis. Rather, the critical assumptions have more to do with shapes of utility functions, homogeneity of preferences and beliefs, and the kind of information used and how it is used. Noting that these assumptions have no empirical support, he suggests that supportable behavioral assumptions be used instead to improve the accuracy of economic predictions. His own models of bounded rationality would be candidates, as would models proposed by conference participants Einhorn and Hogarth and Tversky and Kahneman. Kenneth Arrow appears to agree with many of Simon's arguments, particularly the idea that auxiliary assumptions about information and markets, rather than rationality *per se*, drive much of neoclassical analysis. Since such analysis frequently yields multiple equilibria, Arrow considers that more realistic assumptions might reduce the number of equilibria. A slightly more conservative challenge was presented by Kahneman, Knetsch, and Thaler. In general, they caution against unbridled introduction of noneconomic variables into economic analysis. But they argue that enrichment of the models with a behavioral assumption might be useful provided it "...specifies conditions under which observations deviate significantly from the basic model and only if it predicts the direction of these deviations."

My favorite selections are the classical defense of rationality articulated by Lucas and the discussions of his paper by Winter and Zeckhauser, all of whom are economists. Lucas notes that the multiple equilibria possible in economic analysis are reduced by looking only at those that would be achieved by adaptation after repeated exposures. He is accepting as the realm of economics those stable patterns of preferences. Winter argues that realm is not large enough to deal seriously with policy issues involving changes or new situations and urges the building of an empirical science with broader scope. Zeckhauser is somewhere in between, noting that the behavioral-rational debate is a turf battle more than a theoretical battle. He notes that behavioralists can always produce a counterexample for any tenet of rational choice; and that rationalists can always construct a rational example for real-world "violations" of rational behavior. There is plenty of room for both as long as they stay in their own domains.

The strongest defenders of rationality turn out to be the finance representatives, Merton Miller and Allan Kleidon. In discussing alleged anomolies in financial economics such as dividend payments and excess volatility, they each question whether the phenomena exist in the first place or whether other models of behavior would be useful.

Since accountants have been applying both psychology and economics in their research, this volume should be particularly relevant to turf battles we have been experiencing for a long time. Although the readings generally reflect ideas with which the authors have been previously associated, the opportunity to have them packaged together should not be lost. They give us the opportunity to trace paradigmatic differences to basic differences in the level of analysis used by behavioralists and rationalists. In recognizing these differences, we should gain greater appreciation and tolerance for the work of others. We should also begin to search for instances in which our interests intersect and our methods provide multiple ways of viewing the same problems. This book should be quite useful in a variety of doctoral seminars: behavioral, empirical, and economic.

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M. S. Levitt and M. A. S. Joyce, *The Growth and Efficiency of Public Spending*, The National Institute of Economic and Social Research, Occasional Papers XLI (Cambridge, New York, New Rochelle, Melbourne, and Sydney: Cambridge University Press, 1987, pp. xiv, 201, $39.50).

This book is part of a series of NIESR monographs on the British economy. Generally, the study examines growth patterns of government spending in Britain, identifies contemporary problems in measuring the efficiency of public service operations, and illustrates certain quantitative techniques that might be used to assess government efficiency.

The work is divided into four major sections. In Part I, historical trends in British government spending since 1960 are analyzed, and projections made for future spending patterns into the 1990s. Major findings of this section are that spending by Conservative versus Labor governments was not as different as might initially be expected, and that zero productivity growth alleged in British government operations is largely the result of national income accounting conventions wherein government outputs are measured by volume of inputs (number of employees). Unlike the private sector, government sector productivity cannot be evaluated based upon national income accounts. This conclusion highlights the need for quantifiable output measures in order to more accurately assess government efficiency.

With this theme in mind, the authors proceed to a conceptual overview of government output measurement issues in Part II. Also included in Part II are discussions of practical problems in measuring output and, hence, efficiency, of various British and U.S. government activities. Of particular interest is discussion of problems in the U.S. productivity measurement system and the governmental output data maintained by the Bureau of Labor Statistics. Researchers interested in studying U.S. government productivity levels may find the authors' discussion on this subject particularly useful, at least as a starting point in examining public sector efficiency in the U.S.

Part III provides an intuitive explanation of technical and allocative efficiency concepts, plus a fairly general discussion of regression and data envelopment analysis approaches to measuring technical efficiency of government activities. Empirical application of these approaches to the areas of education, health care, and police activities are also demonstrated in Part III. Part IV of the monograph contains summary comments and remarks. Several appendices provide more detailed discussion of relevant efficiency measurement techniques.

The book's strength is in Part II, particularly the conceptual discussion of output measurement for public sector services. Clear distinction is made between intermediate outputs versus "social consequences" or ultimate outputs. Practical measurement difficulties for ultimate outputs are discussed fairly well. Also the authors address in a cogent yet concise manner, the problems of weighting multiple outputs where relevant market prices are nonexistent. They effectively demonstrate their point by citing examples from the Soviet system where focusing performance evaluation on a single output dimension while neglecting all others has resulted in dysfunctional and undesirable behavior.

Part II also contains a section comparing extant productivity measurement approaches of selected British government departments to productivity measurement in several private sector counterparts. Compared to the public sector, private firms generally were found to produce substantially more detailed data concerning manpower usage, intermediate outputs, and costs incurred to date, all of which are useful for planning and control purposes. Governmental productivity data tended to be more aggregative in nature, and presumably less useful for assessing individual unit performance and controlling operations. This finding is interesting since the authors also argue that there is substantial evidence of productivity growth in many government sectors, yet "no overwhelming evidence that the government departments are markedly inferior in their performance to private institutions, despite significant differences in the financial incentives to the staff concerned" (p. 66). If government departments truly are as efficient as private sector firms, how can such productivity levels be achieved in the absence of detailed productivity data? Are detailed data really needed to achieve productivity gains? If yes, then doubt is cast upon the validity of the private versus public sector productivity comparisons (which the authors do admit as being fairly crude).

Overall the monograph provides a valuable resource, particularly for individuals just starting their research efforts in the field of public sector productivity measurement. Also the conceptual discussion concerning output measurement and the simplified presentation of efficiency concepts and quantitative measurement techniques should be quite useful in a graduate level course on governmental/nonprofit management control. However, since the book was written to appeal to a fairly wide audience, the technical discussions of regression, DEA, and frontier analysis are insufficient (even with the appendices) to make the work a comprehensive reference tool for researchers currently working in the area.

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WAYNE J. MORSE, HAROLD P. ROTH, and KAY M. POSTON, *Measuring, Planning and Controlling Quality Costs* (Montvale, NJ: National Association of Accountants, 1987, pp. x, 121, $12.95 paper).

A recent survey by *Newsweek* (Feb. 22, 1988) shows that 40 percent of Americans think that Japanese products are better than similar American products. Two reactions are possible: (1) that *many* or (2) that *few* feel that American products are inferior. To compete effectively in the international market, it is essential that the quality of American products improve, because consumers are not only price conscious but also quality conscious.

This book raises important issues about how accountants may contribute to quality improvement—in manufacturing and service industries. The main purpose is to introduce the concept of quality costs to managerial accountants by identifying major questions in the measurement, planning, and control of quality costs. The need to focus more on quality costs is obvious. As the text points out (p. 29) "quality costs for many U.S. companies range between ten and 20 percent of total sales, while careful management can reduce quality costs to 2.5 percent of sales."

The book is divided into two major sections. The first deals with the framework for a quality cost reporting system and the other contains four case studies. Chapter 1 introduces basic concepts and background on quality costs and is followed by a discussion which relates quality to productivity. In the third chapter, various components of quality costs are identified: cost of prevention, appraisal, internal and external failure. Chapter 4 discusses the limitations of quality cost information. This is followed by step by step instructions on the installation of a quality cost reporting system.

Section 2 contains case studies of four organizations—North American Philips Consumer Electronics Corp., the Federal Reserve Bank of Philadelphia, ITT Corp., and Xerox Corp. These cases are interesting and insightful. They cover a wide range of organizations. This is especially true for the Federal Reserve! Yet, "the basic concepts can be adapted to many types of organizations" (p. 101). At the same time, each organization's emphasis is somewhat different. For example, Xerox has a much broader definition of quality costs, which includes, among others, losses due to currency fluctuation.

The text is short and readable. Overall, it is successful in meeting its goal as an introduction to quality cost accounting, a subject which has to date been neglected in leading texts. For example, Horngren and Foster [1987] currently has less than three pages on quality costs and one reference to productivity as an example of nonfinancial performance measures (p. 885). Morse et al. claim that "Management accountants, through quality cost measurement and reporting, can make an important contribution to enhancing quality and productivity" (p. 15). While this statement may promote quality cost reporting, which will help reduce production cost, it understates the potential contribution accountants can make to improve quality and productivity. Accountants, after all, are well positioned to make assessments of performance and to offer suggestions for quality improvement. Unfortunately, their training in this area has been shallow. With this in mind, three shortcomings in the book's general framework should be noted.

First, the underlying assumption in the quality cost concept is that the level of quality is exogenous and predetermined. This may be reasonable when one is interested only in implementing a practical reporting system where a quality/price tradeoff does not exist. However, consumer demand is not independent of quality. Quality and characteristics of many products change very rapidly in response to consumer demand and technological changes, e.g., electronics/computers. When adjusted for quality improvement (by the use of hedonic indices), the price index of computers fell from 617.3 in 1969 to 68.5 in 1984 (*Survey of Current Business*, March, 1986). Although this may be an extreme example, it illustrates that minimization of cost may not be the only, or even the major, strategic concern of the firm.

Second, the relationship between quality and productivity needs to be understood better and traditional methods which emphasize labor productivity must be improved upon. This requires measurement of quality adjusted output as well as quality adjusted inputs. Measurement of multifactor productivity (used by the Bureau of Labor Statistics, AT&T, General Foods, and other organizations) is one way to keep track of how efficiently resources are used.

Third, the opportunity cost of not conforming to "customer expectations" has to be stressed more. Customer satisfaction is derived from many dimensions, not only those relating to product specifications but also to the general way external failure is dealt with. In other words, customers purchase a basket of characteristics which include not only the product itself but also service, etc. "Opportunity cost of lost sales because of bad quality reputation" can be very large, but is difficult to quantify in the form of quality costs. Nevertheless, effort can be made to estimate these costs by conducting consumer surveys, by estimating the repeat purchase rate, etc. In other words, a quality cost reporting system can include supplementary data which are not necessarily expressed in dollar terms. In fact, according to the *Wall Street Journal* (March 8, 1988), some corporations (e.g., Xerox, Ameritech) are linking executive compensation to measures of customer satisfaction.

The book demonstrates clearly that accountants have much to contribute in this area. At the same time it is also clear that much more work needs to be done in the area of quality cost reporting.

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REFERENCE

Horngren, Charles T., and George Foster, *Cost Accounting: A Managerial Emphasis*, Sixth Edition (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1987).

JAMES A. OHLSON, ***The Theory of Financial Markets and Information*** (New York, Amsterdam, and London: North-Holland; distributed in North America by Elsevier Science Publishing Company, Inc., New York, 1987, pp. xiii, 181, $38.95).

This book provides a very useful bridge between finance, economics, and accounting. It does not deal with accounting *per se*, even though the author is a distinguished accounting researcher. Instead, it provides a compact examination of the theory of financial markets and the impact of information in those markets. The theory examined in this book is fundamental to understanding the role of accounting in financial markets.

The book focuses on the *pricing* of financial claims, the *allocative efficiency* of financial markets, and the *welfare implications of changes* in the set of tradeable claims and the public information structure. The author carefully develops a unified approach in which the relationships among various analyses are clearly identified. The thoroughness of the analysis is facilitated by restricting the scope of the economy considered. In particular, the analysis considers a finite-state two-date economy in which there is only pure exchange and all information is publicly reported.

In considering pricing issues and the efficient allocation of consumption across time and states (risk sharing), there is considerable merit in restricting the analysis to a pure exchange economy. That analysis is directly applicable to a production choice economy, and is more easily understood in the pure exchange economy. (The drawback is that the use of public information to facilitate efficient allocation of resources among production alternatives is not considered.) Similarly, much of the analysis of a two-date economy can be directly extended to a more general T-date economy, and the former is easier to understand. Finally, while the analysis of a public information economy cannot be directly extended to an economy in which there is private information, a thorough understanding of the former is useful background prior to examining the latter. Hence, while the scope of the book is limited, the author examines theoretical developments that are fundamental to understanding a broad set of theoretical research that is of importance to accounting.

The book contains a brief introductory chapter followed by two pairs of major chapters. The first chapter in each pair (two and four) provides a partial equilibrium analysis of individual choices within a given economy, whereas the second chapter in each pair (three and five) provides a general equilibrium analysis of the economy. The first pair (two and three) consider a fixed information economy in which no information is reported at date-one and the state is revealed at date-two. The second pair (four and five) consider an economy in which information about the state may be publicly revealed at date-one.

Chapter Two, "Microanalysis Under Fixed Information," specifies the basic individual choice model in a financial market in which no information is reported at date-one. Implicit prices for state contingent claims, which are a fundamental element of the analysis throughout the book, are introduced and related to the concept of "no-arbitrage opportunities." Optimal consumption/investment choices are characterized both for general concave utility functions and for utility functions characterized by linear risk tolerances. In subsequent chapters, the impact of restricting the analysis to utility functions with linear risk tolerances is carefully and insightfully delineated.

Chapter Three, "General Equilibrium Analysis Under Fixed Information," characterizes an equilibrium in the economy in which no information is reported at date-one. The equilibrium is demonstrated to be constrained Pareto efficient, and sufficient conditions for the achievement of full Pareto efficiency are thoroughly explored. Two sections explore the impact of changes in the set of tradeable claims, including a clear demonstration of the use of puts and calls to "complete" the market. A final section extensively examines the theory of security valuation, including consideration of arbitrage based valuation, the Modigliani-Miller theorem, risk adjustments in pricing, and the CAPM model. This latter section is noteworthy in that it provides a cohesive and insightful summary of many results from the pricing literature, developing them within the book's basic model.

Chapter Four, "The Microanalysis Of Information," specifies models of individual choice when information is released at date-one. Three trading regimes are considered: no prior trading, sequential trading at a prior date and at date-one, and prior trading of signal-contingent portfolios. Conditions under which the latter two regimes are equivalent are identified (e.g., dynamically complete markets), justifying extensive analysis of the third regime even though the sequential trading regime is more "realistic."

Chapter Five, "General Equilibrium Analysis Under Varying Information," characterizes the equilibrium for each of the three trading regimes when information is released at date-one. Constrained and full Pareto efficiency are again considered, but now those concepts are defined relative to a given information structure. The welfare implications of alternative information structures are considered, insightfully relating this comparison to the comparison in Chapter Three of alternative sets of tradeable claims. The chapter concludes with an examination of the relationship between information and market values.

As stated earlier, this book carefully examines a body of theoretical research that is fundamental to understanding the role of accounting in financial markets. It does not deal with accounting *per se*, but I recommend this book to accounting Ph.D. students and scholars. There is extensive use of mathematical analysis, but knowledge of linear algebra and Lagrangian analysis is the only mathematical background required to understand the material. Students will gain maximum benefit from this book if they have had a basic finance course dealing with financial markets and a course in microeconomic theory (e.g., a course using a microeconomics text such as Varian's).

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LEE H. RADEBAUGH, *International Aspects of Segment Disclosure: A Conceptual Approach*, Research Monograph No. 2 (Glasgow: Department of Accounting and Finance, Glasgow Business School, University of Glasgow, 1987, pp. 87).

As noted in the introductory chapter, "[t]he purpose of this monograph is to analyze the international dimensions of segment disclosures (both by line of business and geographic segments) and to relate those dimensions to current and future research" (p. 10). Chapters 2 and 3 relate most closely to the first part of this purpose. Chapter 2 contains a review of segment requirements and recommendations that have been developed by U.S., U.K., and international standard setters. Illustrative segmental disclosures from a Dutch-, a U.K.-, and two U.S.-based multinational firms are provided. Chapter 3 examines certain historical antecedents that underlie the standards reviewed in Chapter 2. In Chapter 3, the author notes the varying information demands of investors, governments, and employees. He emphasizes the particular interest of the latter two groups in the geographic disclosures of multinational enterprises.

In these two chapters, the author quite adequately accomplishes his stated purpose of describing the "international dimensions" of segment reporting. Given the current thrust toward an "internationalization" of the accounting curriculum, these chapters might serve as a useful addition to an undergraduate or graduate financial accounting course. The segmental reporting issue lends itself well to "internationalization." It is a topic with clear multinational implications and without undue complexity. One caveat, however, as to the author's presentation: A more careful integration of the standards (Chapter 2) with the historical background (Chapter 3) would have enhanced the readability of the chapters and have eliminated the many disjointing references to "as noted earlier."

The last two chapters of the monograph (Chapters 4 and 5) appear to embody the author's desire to provide a research framework for segmental disclosure. After a brief discussion of market efficiency, information fineness, and the FASB Conceptual Framework, the author reviews two empirical studies that used industry segment data to predict consolidated earnings and a recent paper that related geographic disclosures to market risk. The purpose of the discussion was to indicate that segmental disclosures should provide information useful to the assessment of both risk and return. The author concludes (in Chapter 5) with four recommendations for improved geographic disclosure: (1) greater disaggregation; (2) integration of both geographic and industry disclosures in a matrix format; (3) more flexibility with regard to the disclosure of geographic profit data; and (4) more attention to the qualitative discussion of foreign operations (p. 80).

The major problem with these latter chapters is an uncertainty as to the intended audience. The academic researcher with an interest in segmental reporting will be well-acquainted with the Chapter 4 and 5 material. He or she would find "nothing new" in the research review or in the author's conclusions with regard to the costs and benefits of improved segmental disclosure. Even the less sophisticated reader might find the chapters fairly uninformative. The descriptions of market efficiency and the fineness theorem are superficial, and the author's recommendations for improved disclosure are quite intuitive. Clearly, the identification of an intended audience could have enhanced the usefulness of the monograph.

Overall, the monograph draws heavily upon the author's previous geographic disclosure research. Though it contains little "new" material, it does "internationalize" a financial reporting topic and, as such, may be of interest to those who wish to add this dimension to their knowledge of the segmental reporting issue.

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MICHIHARU SAKURAI, Editor, *Software Cost Accounting* (Tokyo: Hakuto Shobo, 1987, pp. 224, ¥2,300).

There have been very few books, if any, written by both academicians and practitioners in Japan in an emerging area such as Software Cost Accounting. Indeed, at a time when the economic scale of software development costs exceeds ten percent of capital investment in private industry in Japan (amounting in 1984 to ¥4,700 billion on the basis of GNP), exploring the concept as well as the application of software cost accounting is a worthy endeavor. This is bolstered by the fact that the ratio of computer software cost has now reached 80 percent of the total information processing cost, as highlighted by the author.

Bearing in mind this background as well as the unpreparedness and insufficiency of cost accounting systems in the information services industry in Japan, Sakurai has edited the results of a study sponsored by the Cost Accounting Subcommittee in the Finance Committee of the Japan Information Service Industry Association. Accordingly, this book is written by four authors: Chapters 1 through 6 and Chapter 10 are written by Sakurai, whereas Chapters 7 through 9 are written by three different practitioners. Each practitioner represents a different computer software company, i.e., Kudan Computer Services, Inc., Japan Electronic Development, Inc., and JCE, Inc.

The contents are divided into three parts. Part One is Fundamental Theory of Software Cost Accounting, consisting of six chapters: Knowledge Information Society and Transition of Industrial Management, Economic Characteristics of Software and Its Nature as Assets, Principles of Software Cost Accounting, Mechanism of Software Cost Accounting, Software Cost Management, and Mechanism of Software Pricing Decisions.

Part Two is composed of three case studies. The title of each case is: Cost Accounting System in the Computer Service Company and Its Problems to Be Resolved (Chapter 7), Cost Management of the Software Development Company (Chapter 8), and Product Costing and Budgetary Control in the Software Development Process (Chapter 9). Finally, Part Three is the result of the survey of cost accounting systems in the information services industry.

The significance of this book is threefold: First, in view of the fact that no pertinent guideline is given as to how to deal with software cost, except for the Tax Code in Japan, this book is most likely to play a pioneering role as the first step in formulating a desirable cost accounting system. Indeed, without such a guideline, the usefulness of financial statements must be seriously limited for analytical purposes since each company uses different cost accounting approaches.

Second, a most extensive survey is included in this book. There have been three major surveys in 1975, 1979, and 1982, respectively. However, the number of the companies responding was at most 83 in the 1975 survey, while the survey in this book contains 175 companies out of 398 where the questionnaires were sent (collection rate is 44 percent).

Third, this book includes both concepts and applications. While this combination is very popular in the U.S., it has not been the case in like literature in Japan.

Some of the issues worth exploring included in this text are: What are the essential differences between software cost accounting and traditional hardware cost accounting in light of cost objectives, object of costs, input-output relations, cost structure, relationships with job-order costing, R&D, and construction accounting, etc.? What would be a desirable costing method in a software cost accounting system—process costing, job-order costing (with departmental overhead rates), standard costing, or other costing methods? What would be a commendable pricing mechanism or decisions to be made—cost-plus, market pricing, or other methods? And finally, how could a unified software cost accounting system in the information services industry be established by gathering many more cases to find overall and specific characteristics or simply by applying the hardware cost accounting system to software?

Since no more space is allowed to elaborate these issues, I strongly recommend that this book be translated into English so that the concept and practice of software cost accounting in Japan may be read by many more scholars and practitioners.

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Terry K. Sheldahl, *Beta Alpha Psi, From Omega to Zeta Omega: The Making of a Comprehensive Accounting Fraternity, 1946–1984* (New York and London: Garland Publishing, Inc., 1986, pp. xxii, 851, $85.00).

This is a sprawling book from its title (17 words) to its 16 chapters (almost averaging 50 pages each). This opening sentence is almost exactly similar to the one with which this reviewer started his review of the preceding book by the same author, *Beta Alpha Psi, From Alpha to Omega: Pursuing a Vision of Professional Education for Accountants, 1919–1945*, several years ago (The Accounting Review (October 1984), p. 715). In the previous volume, the author details the accounting fraternity's past and origin chiefly in the period between the two world wars; in this second volume, the history is largely of the 40 years since World War II. In both works, the author obviously did not have the services of an editor. Nevertheless, as source documents, both books are invaluable.

Reflecting the post-World War II changes in the country, the fraternity changed its attitude to women and minorities. The fraternity started admitting women in the autumn of 1950. Most chapters started admitting women immediately. The Omicron chapter at Ohio State effectively merged the members of an accounting sorority including alumnae. Women soon became chapter officers and chapter advisors. A number of women were named to the fraternity's advisory forum and its national council (now called the board of directors) in the late 1970s and the 1980s. In less than three decades, two women were elected national presidents: Doris M. Cook, University of Arkansas, 1977–1978, and Joyce C. Dean, Baylor University, 1980–1981. To date, no other U.S. accounting organization has named a woman as its head.

Although there is a black member of the forum, only a single black has been elected to the board as an alumni representative, Leroy Tanker, University of Alabama, 1977–1978. However, in 1987, Larzette Hale, a black woman faculty member and chairwoman at Utah State University, was elected to the board. She will become national president in 1990–1991. Again, no other U.S. accounting organization has announced plans to elect a black as its head.

The sheer growth of the fraternity over the four decades is most impressive. From a pre-war total of 21 chapters, it has increased almost eight times to 162 (by 1984). Among the requirements for the establishing of a chapter on a university campus, the chief one is accreditation of the business school by the American Assembly of Collegiate Schools of Business. This requirement has hindered the fraternity from going international by establishing Canadian university chapters. Efforts to start chapters at universities having only graduate students also have been unsuccessful. Similarly, efforts to start separate alumni chapters have not flourished. Although graduate students may be inducted, the typical chapter largely emphasizes admission of, and professional and social activities for, high grade-point undergraduate accounting majors.

Since continuity in a chapter depends to a high degree on a chapter's faculty advisor, such posts are a key variable in a chapter's achievements. Unfortunately, the increased emphasis on research productivity in many universities seems to work against many faculty accepting the advisor's role. Despite the fraternity's truly impressive and extensive activities at many levels (chapter, regional, national), the fraternity continues to have major problems attracting faculty to serve not only as chapter advisors but also at other levels of leadership as well. However, those faculty who accept and hold such posts are highly regarded for their devotion to the fraternity; their commitment is as impressive as that of the members of the American Accounting Association.

Although no index was provided in the first volume, indexes for both volumes are included in the second one. The indexes are comprehensive. For example, the index for volume two consists of three groupings: colleges and universities, individuals, and organizations.

Although the reviewer was a national officer of the fraternity several years ago (but did not exercise any direct influence over how this historical research was developed and prepared), he found somewhat to his surprise that he could not remember all of the details of these years as related by the author; but, of course, the author had reviewed not only all the fraternal records but had interviewed extensively living former fraternal officials. The thousands of alumni of this fraternity and the current active members will find this history most interesting (in particular where it concerns their chapter).

Thomas J. Burns
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Srinivasan Umapathy, *Current Budgeting Practices in U.S. Industries* (New York; Westport, CT; and London: Quorum Books, 1987, pp. xxxix, 176, $37.95).

Given budgeting's prominence in practice, teaching, and research, relatively little is known about it. Umapathy believes that two factors contribute to this situation (p. xxvii):

> 1. Current budgetary practices have not been documented, and we do not know what constitutes effective budgeting.
> 2. We do not have a comprehensive model of how to prepare and use budgets effectively.

His book, a survey of current budgetary practices in large- and medium-sized firms from nine industries, is written for managers, accounting researchers, and accounting instructors. Umapathy presents his survey results and examines budgetary practices common to successful firms. He compares his results to those of a prior comprehensive survey—the 1958 book by B. H. Sord and G. A. Welsch, *Business Budgeting* (Controllership Foundation). In addition, he presents a conceptual model for planning and control systems.

The results are reported for 402 firms providing usable responses to a questionnaire (40 percent response rate). The questionnaire, reproduced along with a summary of responses in Appendix I, focuses on five areas: company characteristics (e.g., strategic mission, overall financial performance), management philosophy (e.g., how specific budgets or goals are established, difficulty in achieving financial targets), long-range planning (e.g., frequency of updating long-range plans), budgeting (e.g., information used as standards, types of forecasts used), and the budget manager (e.g., job title, education). Secondary data for the firms were collected on geographical location, sales, assets, number of employees, return on equity, major product line, extent of diversification, and price-to-earnings ratio.

Chapter 1 presents the research objectives of the study and a comprehensive description of the methodology employed. The results for each of the five parts of the questionnaire are reported in Chapters 2 through 6. Umapathy briefly discusses the results and presents a concluding section to each chapter summarizing his findings. A table of response frequencies and percentages is presented by industry and in total for most of the questions in the survey. We learn, for example, that just 27 percent of the firms use flexible budgeting and that over one-third of the commercial banks, diversified financial firms, and hospitals reported significant changes in their budgetary practices in the past year. Chapter 7 examines changes in budgetary practice since 1958 and discusses the apparent beneficial and adverse effects of the changes on performance. For example, compared to 1958, more firms are updating their long-range goals yearly. Meanwhile, the lack of congruence between performance reports and responsibility structure has widened markedly. In Chapter 8, the relationships among budgetary practices and company characteristics are reported. From these Umapathy concludes that situational factors influence budgetary practices. Chapter 9 reports budgetary practices associated with successful firms and Umapathy offers guidelines to improve budgetary performance.

While the findings of this chapter are quite interesting, I wondered about the less successful firms. Did they use the same practices also? If not, how did the practices differ between more successful and less successful firms? In Chapter 10 Umapathy presents his conceptual model for effective planning and control systems along with a discussion of the implications of his study for managers and academics. The model, which combines accounting, organizational behavior, and management policy viewpoints, relates budgetary controls to other organizational subsystems. A section explicitly integrating the results of the survey with the conceptual model, however, would have been interesting and informative.

This carefully executed study is comprehensive in scope and presents a considerable amount of data. It also is well organized and clearly and succinctly written. Umapathy does an excellent job of presenting and integrating his findings through tables, lists, and concise summaries, which makes the book particularly usable as a reference. This description of budgetary practices is an important contribution to our knowledge of the budgeting process. The book is a valuable resource for those researchers interested in budgeting issues and for those managerial accounting professors who wish to include discussions of current practice in the classroom.

JEAN C. COOPER
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GRACE W. WEINSTEIN, *The Bottom Line: Inside Accounting Today* (New York and Scarborough, Ontario: New American Library, 1987, pp. 233, $19.95).

It would seem extraordinarily difficult for an author to write a 233 page book without a single original thought, but Grace Weinstein has managed to do so. This slim volume purports to give readers "...a fascinating inside look at modern accounting, a profession once identified with the drudgery of record keeping, but now at the power center of industry and government." It doesn't.

The book does not discuss accounting, *per se*. It is, instead, an extraordinarily superficial ramble through the supposed controversies, such as the conflict between independence and performing management consulting, that are supposedly shaking the public accounting profession. Anyone who has read—even just glanced at—the sanitized *Journal of Accountancy* over the past few years would have a more complete comprehension of the issues.

Ms. Weinstein seems incapable of writing her own thoughts. Instead, she quotes *ad nauseam*. Even the most minor notion is attributed to one or another accountant. Some sources are quoted repeatedly. Sandy Burton, Robert Elliott, and Michael Cook appear dozens of times. This is not all bad. Who else but Bob Elliott would have used "gestalt" in connection with accounting.

Unfortunately, Ms. Weinstein seems to have interviewed her subjects over the telephone, rather than in person. How else to explain her total failure to describe her sources by other than their firm affiliations. Surely, no sentient author could have avoided "owlish" to describe Mr. Elliott or "jovial" for Dr. Burton.

Disputations over accounting theory rate about three scattered pages. Even these microscopic discussions are notable for their lack of comprehension: Ms. Weinstein uses FASB No. 94 on consolidation of all majority owned subsidiaries as an illustration of how accounting can "affect the bottom line."

It would have been nice to have a book to send to one's parents to explain what their accountant son or daughter does. Unfortunately, this isn't it.

LEE J. SEIDLER
Senior Managing Director
Bear, Stearns & Co., Inc.

NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

The Abraham J. Briloff Lecture Series on Accounting and Society 1985–1986 (Binghamton, New York: School of Management, State University of New York at Binghamton, 1988, pp. 36).

Complete text of first two annual lectures in the Abraham J. Briloff Lecture Series, held at The School of Management, State University of New York-Binghamton, in 1985 and 1986. Series addresses the "public responsibility of the profession and the academic study of accounting." A short address by Philip M. Piaker (SUNY-Binghamton) is entitled "Abraham Briloff's Vision." Full papers include: Sidney Davidson (University of Chicago) "Accounting and Public Policy: Internal Control and External Reporting" (1985) and A. A. Sommer, Jr. (Morgan, Lewis & Bockius and Chairman-Public Oversight Board) "Is There Hope for Self-Regulation?" (1986). Abraham J. Briloff (Baruch College-City University of New York) has written a response to A. A. Sommer's lecture.

SEBASTIAN CHONG, HO HIN DONG, TAN MUI SIANG, TAN TECK MENG, and M. C. WELLS, *Who Audits Singapore* (Singapore: Singapore University Press, 1986, pp. 60, $13.50 paper).

First in a series on the auditing services market in Singapore. Volume reviews 120 companies listed on the Singapore Stock Exchange, using data from companies' annual reports for the years ended December 31, 1983 and 1984. Analysis includes: (1) audit fees paid by companies and to which audit firms they were paid; (2) changes in audit fees over the two years; (3) how audit fees relate to companies' key statistics (e.g., sales and total assets); (4) size of the audit services market; (5) ranking of audit firms on the basis of audit fees and number of clients. Also examined are audit fees according to industry sector and the industry specializations of larger firms. Study shows the dominance of select larger firms in the entire audit services market in Singapore, as well as within certain industries.

IRIS WEIL COLLETT, *The Ultimate Rip-off: A Taxing Tale* (Sun Lakes, AZ: Thomas Horton and Daughters, 1988, pp. v, 217).

A "suspense novel" to teach tax concepts to novices. Designed for use in MBA programs or law school as a supplementary text in public finance, taxation, accounting, or auditing courses. Plot involves the uncovering of a strictly fictional scheme concocted by a corrupt IRS official and a rare coin business to use income tax revenues to finance construction of a neutron bomb. Presumably, the hero, an IRS Special Agent, prevails.

ROGER COWE, Editor, *Handbook of Management Accounting*, Second Edition

(Hants, England and Brookfield, VT: Gower Publishing Company, Ltd., 1988, pp. 468, $98.95).

Book consists of 21 chapters, divided into four parts. The first two parts address planning and control, while the latter two cover special issues. Essays on the topic of planning and control include: "Strategic Management Accounting," Kenneth Simmonds; "Capital Budgeting," Richard Dobbins and Richard Pike; "Budgeting and Cash Forecasting," Douglas Garbutt; "Alternative Budgeting Methods," John MacArthur; "Absorption Costing" and "Marginal Costing," J. Lewis Brown; "Variance Accounting," C. Stuart Jones; "Costing for Planning," Michael Bromwich; "Relevance in Controls," David Allen and Roger Cowe; "Divisional Performance Measurement," David Fanning; and "Management Auditing," Janusz Santocki. Part three, "Beyond Manufacturing," includes the following essays: "Marketing and Management Accountant," Richard Wilson; "Physical Distribution," Gordon Hill; and "Not-for-Profit Organisations," Duncan Bennett. Under "Special Issues in Management Accounting," "Organisational and Behavioural Issues," Roger Groves; "Pricing," John Selzer; "Transfer Pricing," Jeffrey Davies; "Cost Reduction," Anthony Hollis; "Value Added," Bernard Cox; and "Mathematical Techniques," Roger Groves. An appendix contains pertinent terminology. Roger Cowe, who wrote the Introduction and co-authored one essay, is a writer, lecturer, and consultant specializing in business and finance.

SIDNEY DAVIDSON, CLYDE P. STICKNEY, and ROMAN L. WEIL, *Accounting: The Language of Business*, Seventh Edition (Sun Lakes, AZ: Thomas Horton and Daughters, 1987, pp. 131).

Seventh edition in same format as earlier versions. Contains glossary of accounting terms; General Electric's 1987 annual report and comments; Penn Central Transportation Company's pre-bankruptcy balance sheet; accounting magic; and pronouncements governing generally accepted accounting principles. Glossary presents definitions of terms as they are used in accounting reports. For terms with diverse meanings, the definition which is deemed to augment the user's understanding of the term is provided and variant definitions used in practice are included. Terms which are self-contradictory, but nevertheless used in practice, are defined as such. General Electric's 1987 annual report is commented upon by the authors to facilitate understanding of this and other financial statements. Penn Central's pre-bankruptcy balance sheet and income statements are included to illustrate the problems inherent in evaluating stockholders' equity in order to forecast bankruptcy (Penn Central's 1969 balance sheet showed retained earnings of approximately half a billion dollars and total shareholders' equity of $1.8 billion). The section on accounting magic demonstrates how two firms, identical in all respects, can apply generally accepted accounting principles in alternative ways to the same events and produce different reported income figures. The final section lists accounting pronouncements which contain most of the generally accepted accounting principles. This seventh edition differs from the sixth in that a section on accounting for changing prices, included in the sixth edition, has been omitted. In addition, this edition incorporates additional suggestions and corrections solicited from readers. Sidney Davidson and Roman L. Weil are Professors at the University of Chicago. Clyde P. Stickney is Professor at Dartmouth College.

ALAN GART, *Handbook of the Money and Capital Markets* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 320, $49.95).

Twelve chapters discuss investment instruments and the markets in which they trade. The author cites several trends which have influenced and altered the structure of financial markets, including deregulation, securitization, and disintermediation. Written for portfolio managers, and other professional investors as well as private investors, the book intends to provide insight to changing markets in which yield spreads are increasingly narrow. Specific topics covered include: money and capital market instruments; recent developments in the money and capital markets; selected debt and equity market relationships and concepts; the underpinnings of basic valuation theory; interest rate spreads and differentials; basic bond portfolio strategies; the determinants of the level of interest rates; credit ratings for debt instruments; signals or "red flags" that investors might follow to minimize default risk; the new mortgage instruments; tax-exempt securities; securitization, junk bonds, and insured bonds; interest rate swaps; and foreign exchange options. Jerry Belloit (University of

North Florida) has written the chapter entitled "The Mortgage Market" and John B. Guerard (Lehigh University) has written "Introduction to Foreign Currency Options." Alan Gart is Professor of Finance at Lehman College of the City University of New York and Visiting Professor at Columbia University's Graduate School of Business.

CHARLES KOHLER, *Five Years Hard! Memoirs of an Articled Clerk 1928–1933* (London: The Institute of Chartered Accountants in England and Wales, 1987, pp. 44, £5.95 paper).

Author recounts his experiences as an articled clerk for a London accounting firm during the years 1928–1933. At the time, clerks paid a premium for their articles and received little or nothing for their services. Five chapters include period photographs of London and machinery used in the practice of accounting. The introduction was written by E. Kenneth Wright, a past president of the Institute. Charles Kohler spent his career in London with one firm of chartered accountants, served as an examiner for the Institute, and lectured to Students' Societies.

GRACE LEW, Editor, *Financial Reporting in Canada*, Seventeenth Edition (Toronto: The Canadian Institute of Chartered Accountants, 1987, pp. 248, $32.50).

Detailed results of a survey of the published annual reports of 300 Canadian companies for the fiscal years ended 1983 through 1986. The same companies are used for each of the four years. Six sections cover types of financial statements used; their forms and terminologies; the accounting treatment of different transactions and the items reflected in the financial statements; and the elements of the auditor's report. Also indicated is the degree to which the current practices discussed are in accordance with the Recommendations in the Canadian Institute of Chartered Accountants (CICA) Handbook. In addition, reference is made to differences between Canadian accounting practice, on one hand, and International Accounting Standards and practices followed in the United States by publicly owned corporations, on the other. Two appendices list the companies included in the survey and references to the CICA Handbook in Canadian Legislation and Regulations. Grace Lew is a member of the CICA's Studies and Standards Department's staff.

DAVID MERRIMAN, *The Control of Municipal Budgets* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 172, $37.95).

Book examines tax and expenditure limitations (TELs) in terms of their design and effects and demonstrates how these limitation measures have worked. Chapter One defines TELs and discusses the role of local governments and the means by which they collect revenue. Chapter Two reviews the history of TELs and their current status. Government budgeting in the absence of TELs is the subject of Chapter Three. Chapter Four presents a theoretical examination of government behavior under a TEL. An empirical study of New Jersey's cap law, including its effects on the allocation of municipal-government budgets and on total budget size, is the subject of Chapter Five. The final chapter summarizes the author's findings and draws conclusions about the effects of TELs. Appendices to Chapter Five include: Theory and Alternative Estimates of Tax Capacity; Derivation of Budget Share Equations; and Derivation of an Empirical Test of the Null Hypothesis that Observed Spending Equals Normal Spending. David Merriman is Assistant Professor of Economics at Loyola University of Chicago.

MITSUBISHI CORPORATION, *Tatemae and Honne: Distinguishing Between Good Form and Real Intention in Japanese Business Culture* (New York: The Free Press, a Division of Macmillan, Inc., 1988, pp. x, 182, $19.95).

Subtitled "a glossary of behavior," book contains 500 cross-referenced concepts which are commonly used by Japanese in conducting business. The terms selected for this volume are those which lend themselves to misinterpretation if literally translated. The cultural and historical contexts of each term, as well as nuances, are described to facilitate understanding and use by a non-Japanese speaker in conversation with a Japanese colleague. For example, the term "yanagi no shita" is a shorter form of the phrase "yanagi no shita no nihikime no dojo" which itself is originally from a longer proverb which translates as "you won't always find a loach [a loach is defined as any of a family of small Old World freshwater fishes related to the carps] under the willow tree." The meaning of the proverb is "good luck does not always repeat itself." Businessmen, however, use the term "yanagi no shita" to express expectations regarding an upcoming project (which was preceded by a successful project) to mean the opposite: one success is followed by another. A pronunciation guide and an English index to Japanese terms are included.

L. C. L. SKERRATT and D. J. TONKIN, Editors, *Financial Reporting 1987-88: A Survey of UK Published Accounts* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. xv, 226, £30.00 paper).

This nineteenth annual survey of UK financial reporting practice is divided into Part I, Selected Topics and Part II, Survey Tables and Examples. Part I consists of articles which incorporate examples from the 300 companies included in the survey on the following subjects: "Extraordinary Items," E. Hodgson; "Funds Flow Reporting," N. C. L. Macdonald; "Fair Value Accounting Following an Acquisition," R. M. Paterson; "Historical Summaries," R. M. Wilkins and A. C. Lennard; "Property Companies," J. S. Mellows and K. B. Hudson; "Related Party Transactions," P. R. Hinton; "Research and Development," D. W. Budworth; and "Segmental Reporting," R. A. Padgett. In Part II, D. J. Tonkin and L. I. Watson have compiled tables and examples based on survey results of a subsample of the financial reports for the period ending June 30, 1987. Each table is concerned with a specific area of accounting practice, including auditors' reports; current cost accounting; deferred taxation; extraordinary items; and funds statements, among others. A short commentary follows each table along with examples which focus on select firms. Appendices include a list of companies participating in the survey and a list of topics covered in recent editions of the survey. L. C. L. Skerratt is Spicer and Oppenheim Professor of Accounting at the University of Durham and D. J. Tonkin is Managing Director, The Accountant's Database Limited.

J. DAVID SPICELAND and SURENDRA P. AGRAWAL, *International Guide to Accounting Journals* (New York: Marcus Wiener Publishing, Inc., 1988, pp. 300, $34.50).

Book provides information on approximately 300 journals in accounting and related fields, especially for accounting researchers. Information on each journal includes editors and publishers and their addresses; whether the journal is geared for academics or practitioners; percent of the journal devoted to specific accounting areas; and submission information. Journals are also listed by country. J. David Spiceland and Surendra Agrawal are Professors in the Accounting Department of Memphis State University.

Editor's Note: Catherine McNally assisted the Editor in annotating these books.

BOOKS RECEIVED FROM FEBRUARY 13, 1988 TO MAY 25, 1988

The Abraham J. Briloff Lecture Series on Accounting and Society 1985-1986 (Binghamton, New York: School of Management, State University of New York at Binghamton, 1988, pp. 36).

Accounting, Auditing and Accountability, Volume 1, Number 1 (Bradford, England: MCB University Press, Ltd., 1988, pp. 74, $39.95 Volume 1, Nos. 1-2 paper).

WAYNE P. ALBO and A. RANDAL HENDERSON, *Mergers and Acquisitions of Privately-Held Businesses* (Toronto: The Canadian Institute of Chartered Accountants, 1988, pp. 332, $39.50).

ANTHONY A. ATKINSON, *Cost Estimation in Management Accounting—Six Case Studies* (Hamilton, Ontario: The Society of Management Accountants of Canada, pp. v, 122,

$15.00 paper-members, $20.00 paper-non-members).

Ken Bartlett and Clark Whitehill, "Aspects of Social Security Benefits 1987/88," *Accountant's Digest No. 216*, Winter 1987/88 (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 44, £7.00 paper).

Ahmed Belkaoui, *Inquiry and Accounting: Alternate Methods and Research Perspectives* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 448, $49.95).

Stephen A. Berkowitz, Louis D. Finney, and Dennis E. Logue, *The Investment Performance of Corporate Pension Plans* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xiv, 132, $35.00).

J. E. Boritz, B. G. Gaber, and W. M. Lemon, *An Experimental Study of Review of Preliminary Audit Strategy by External Auditors* (Toronto: The Canadian Academic Accounting Association, 1987, pp. x, 149, $25.00).

Michel Henri Bouchet, *The Political Economy of International Debt* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 224, $37.95).

Victor A. Canto and Arthur B. Laffer, Editors, *Supply-Side Portfolio Strategies* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1988, pp. 200, $35.00).

Cash Management, Guidance to Good Practice Series (London: The Business Support Group of The Institute of Chartered Accountants in England and Wales, 1988, pp. 51, prior to June 30, 1988: no charge; from July 1, 1988: £2.00 paper).

Center for International Education Research in Accounting, *Recent Accounting and Economic Developments in the Far East* (Urbana-Champaign, IL: The University of Illinois, 1988, pp. 234, $10.00).

Sebastian Chong, Ho Hin Dong, Tan Mui Siang, Tan Teck Meng, and M. C. Wells, *Who Audits Singapore* (Singapore: Singapore University Press, 1986, pp. 60, $13.50 paper).

Iris Weil Collett, *The Ultimate Rip-off: A Taxing Tale* (Sun Lakes, AZ: Thomas Horton and Daughters, 1988, pp. v, 217).

Roger Cowe, Editor, *Handbook of Management Accounting*, Second Edition (Hants, England and Brookfield, VT: Gower Publishing Company, Ltd., 1988, pp. 468, $98.95).

Barry E. Cushing, Editor, *Accounting and Culture: Plenary Session Papers and Discussants' Comments from the 1986 Annual Meeting of the American Accounting Association* (Sarasota, FL: American Accounting Association, 1987, pp. viii, 102, $5.00 paper).

Sidney Davidson, Clyde P. Stickney, and Roman L. Weil, *Accounting: The Language of Business*, Seventh Edition (Sun Lakes, AZ: Thomas Horton and Daughters, 1988, pp. 131).

Gordon B. Davis and Thomas R. Hoffman, *Fortran 77: A Structured, Disciplined Style*, Third Edition (New York; St. Louis; San Francisco; Auckland; Bogotá; Caracas; Colorado Springs; Hamburg; Lisbon; London; Madrid; Mexico; Milan; Montreal; New Delhi; Oklahoma City; Panama; Paris; San Juan; Sao Paulo; Singapore; Sydney; Tokyo; and Toronto: McGraw-Hill, Inc., 1988, pp. ix, 434).

Jeremy Edwards, John Kay, and Colin Mayer, *The Economic Analysis of Accounting Profitability* (Oxford, England: Clarendon Press; New York: Oxford University Press, 1987, pp. 133, $39.95 cloth, $13.95 paper).

Kenneth R. Ferris, Editor, *Behavioral Accounting Research: A Critical Analysis* (Columbus, OH: Century VII Publishing Company, 1988, pp. 368, $17.00 paper).

Nathalie Friedman, *Mentors and Supervisors* (New York: Institute of International Education, 1987, pp. 111, $4.00 (for postage and handling from IIE Publications Service, 809 UN Plaza, NY, NY 10017) paper).

Alan Gart, *Handbook of the Money and Capital Markets* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 320, $49.95).

Carole Hyatt and Linda Gottlieb, *When Smart People Fail: Rebuilding Yourself for Success* (New York: Penguin Books, 1988 [Simon & Schuster, 1987], pp. 240, $7.95 paper).

Charles Kohler, *Five Years Hard! Memoirs of an Articled Clerk 1928-1933* (London: The Institute of Chartered Accountants in England and Wales, 1987, pp. 44, £5.95 paper).

Grace Lew, Editor, *Financial Reporting in Canada*, Seventeenth Edition (Toronto: The Canadian Institute of Chartered Accountants, 1987, pp. 248, $32.50).

R. J. Mayes, "Reporting to Management," *Accountants Digest No. 215*, Winter 1987/88 (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 36, £6.50 paper).

Terry W. McAdam, *Doing Well by Doing Good* (New York: Penguin Books, Published by the

Penguin Group, Viking Penguin, Inc., 1988 [The Taft Group, 1986], pp. xxi, 201, $6.95 paper).

David Merriman, *The Control of Municipal Budgets* (New York; Westport, CT: and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 172, $37.95).

Paul B. W. Miller and Rodney J. Redding, *The FASB: The People, the Process, and the Politics*, Second Edition (Homewood, IL: Richard D. Irwin, Inc., 1988 [1986], pp. xvi, 160, $7.95 paper).

Mitsubishi Corporation, *Tatemae and Honne: Distinguishing Between Good Form and Real Intention in Japanese Business Culture* (New York: The Free Press, a Division of Macmillan, Inc., 1988, pp. x, 182, $19.95).

Theodore M. Porter, *The Rise of Statistical Thinking 1820–1900* (Princeton, NJ: Princeton University Press, 1986, pp. xii, 333, $35.00 cloth, $12.50 paper).

John L. Pritchard, *The Cross-Over Point: A Guide for Tax Shelter Owners* (Somerville, NJ: Varick Financial Press, 1988, pp. 169, $12.95 paper).

Lee H. Radebaugh, *International Aspects of Segment Disclosure: A Conceptual Approach*, Research Monograph No. 2 (Glasgow: Department of Accounting and Finance, Glasgow Business School, University of Glasgow, 1987, pp. 87, £9.50 paper).

Peter M. B. Rowland, *Arbitration Law and Practice* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 208, £24.95 cloth, £19.95 paper).

L. C. L. Skerratt and D. J. Tonkin, Editors, *Financial Reporting 1987–88: A Survey of UK Published Accounts* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. xv, 226, £30.00 paper).

J. David Spiceland and Surendra P. Agrawal, *International Guide to Accounting Journals* (New York: Marcus Wiener Publishing, Inc., 1988, pp. 300, $34.50).

Robert R. Sterling, *An Essay on Recognition*, R. J. Chambers Research Lecture 1985 (Sydney: The University of Sydney Accounting Research Center, 1988, pp. 90, $xx.xx paper).

Srinivasan Umapathy, *Current Budgeting Practices in U.S. Industry* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 232, $37.95).

Graham Ward and Andrew Evans, *Pensions—Your Way Through the Maze* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 128, £6.95 paper).

Alex O. Williams, *Managing Risk in Mortgage Portfolios* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 176, $39.95).

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OCTOBER 1988 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233. ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.*

#401 SUFFOLK UNIVERSITY, Boston, MA. The Accounting Department anticipates FT tenure-track position openings for 9/1/89 at UG/G levels in auditing and/or accounting information systems. PhD/DBA in Accounting and evidence of effective teaching, research, and a strong publication record required. CPA, CMA or other certification(s) required. Apply to Ronald Sundberg, Associate Dean, School of Management, Beacon Hill, Boston, MA 02108, or call (617) 573-8301. An equal opportunity, affirmative action employer.

#402 ACCOUNTING FACULTY, CLEVELAND STATE UNIVERSITY seeks candidates for faculty positions in Accounting to teach in new D.B.A. Program. Rank dependent on qualifications. Candidates for assistant professor should have doctorate, CPA, CMA, or CIA and research capacity favorably considered. Candidates for associate and full professor must have doctorate and record of publication. M/F/H Salary negotiable. Send resumé to: Dr. Larry Kreiser, Chairman, Department of Accounting, Cleveland State University, E. 24th & Euclid Ave., Cleveland, OH 44115 (216) 687-4721. Equal Opportunity Employer, minority/female/handicapped.

#403 UNIVERSITY OF NORTH TEXAS—ALL POSITIONS, TENURE-TRACK for the 1989/90 year. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, University of North Texas, Department of Accounting, P.O. Box 13677, Denton, Texas 76203. UNT is an Equal Opportunity, Affirmative Action Employer.

#404 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate, and Full Professor positions anticipated openings for 1989–1990. Tenure-track and one-year appointments are available. Tenure-track positions require a doctorate or ABD, except in taxation which requires a J.D. or MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's needs are for persons who can teach financial accounting (under-graduate and graduate). California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to Dr. Robert Zahary, Chair, Department of Accounting, California State University, Los Angeles, CA 90032.

#405 BOSTON COLLEGE is seeking applications for appointments at the Assistant or Associate levels in Accounting. Applicants for Assistant should possess a Ph.D. or D.B.A. ABD's will be considered. Applicants for Associate must have a proven record in teaching, research, and service. Boston College places a high emphasis on quality teaching. In addition, applicants will be expected to engage in scholarly research and will be supported in their research efforts. The School of Management is AACSB accredited. Boston College is an Equal Opportunity/Affirmative Action Employer. Contact: Dr. Ronald Pawliczek, Department of Accounting, Fulton 400, Boston College, Chestnut Hill, MA 02167.

#406 THE UNIVERSITY OF MINNESOTA, DULUTH invites applications for tenure-track positions (tenured at professor rank) at all levels. An earned doctorate in accounting, preferably from an AACSB accredited school, with CPA/CMA preferred; ABD's nearing completion will be considered. Interest areas preferred are financial accounting, not-for-profit, and information systems. Demonstrated evidence of communication skills appropriate to a faculty position. Salary and benefits are competitive. Applications containing a curriculum vita and names of three references should be sent by November 30, 1988 to Dr. C. Stevenson Rowley, Department of Accounting, University of Minnesota, Duluth, Duluth, MS 55812. The University of Minnesota is an Equal Opportunity Educator and Employer and specifically invites and encourages applications from women and minorities.

#407 THE UNIVERSITY OF TULSA, SCHOOL OF ACCOUNTING, has Fall 1989 openings for tenure-track positions in managerial/cost and financial accounting and auditing/systems. Terminally qualified individuals preferred, but may consider ABD's. Rank and salary depend upon qualifications and offers will be competitive. The University offers the opportunity to provide, and to be rewarded for, balanced contributions in research and teaching at graduate and undergraduate levels. The University has a strong undergraduate tradition in the Liberal Arts and stresses high-quality research and teaching. Send vita to Gordon L. Nielsen, School of Accounting, The University of Tulsa, 600 South College Avenue, Tulsa, OK 74104. An Equal Opportunity/Affirmative Action Employer.

#408 UNIVERSITY OF SOUTHERN CALIFORNIA, School of Accounting is seeking candidates for faculty positions leading to tenure. Faculty positions above the assistant rank are also possible for individuals with strong teaching and publication record. Candidates for assistant professor should have a doctorate in hand or be near completion of the dissertation, strong teaching ability and interest in research. The University of Southern California is an equal opportunity, affirmative action employer. Applications are encouraged from women and minority persons. Please contact Michael Diamond, Interim Dean, School of Accounting, University of Southern California, Los Angeles, California 90089-1421.

#409 THE SCHOOL OF PROFESSIONAL ACCOUNTANCY, UNIVERSITY OF SOUTHERN MISSISSIPPI, invites nominations and applications for the position of Research Professor. A distinguished research record and other academic qualifications that merit appointment at the rank of professor are required. Salary and other support will be highly competitive. The incumbent will be expected to continue productive research and to help develop the research potential of other faculty. Teaching load will be no more than nine hours per year. The SPA is a unit of the College of Business Administration which is AACSB-accredited. Contact: Director, SPA, Hattiesburg, Mississippi 39406-5178. AA/EEO

#410 AMERICAN UNIVERSITY, WASHINGTON, D.C. Applications are invited for a tenure-track faculty position in Accounting. Applicants must be effective teachers with a serious commitment to scholarship and professional service. An appropriate doctorate is required and professional certification is highly desirable. All ranks will be considered. An established record of scholarly productivity is expected for senior ranks. Research and professional opportunities in the nation's capital are excellent. Applications should be sent to: Dr. Philip F. Jacoby, Chair, Accounting Department, Kogod College of Business Administration, The American University, Washington, D.C. 20016. The American University is an equal opportunity, affirmative action employer.

#411 THE UNIVERSITY OF CALIFORNIA AT LOS ANGELES. Applications are invited for positions in accounting at both the junior and senior levels for appointments beginning in July 1989. Applicants must have a Ph.D. degree or be a Ph.D. candidate and must exhibit outstanding research capability. Resumés should be sent to Professor Yoon Suh, John E. Anderson Graduate School of Management, University of California, Los Angeles, CA 90024-1481. Telephone: 213-206-6903. UCLA is an Affirmative Action, Equal Opportunity Employer.

#412 BAR ILAN UNIVERSITY, 52100 RAMAT GAN, ISRAEL. Two openings are available for junior and moderately senior accountants. Candidates should have a doctorate in Accounting or ABD with substantial progress toward completion from the U.S. or British Departments of Accounting or similar departments in other countries. All candidates are expected to immigrate to Israel. The teaching language is Hebrew and candidates should undertake to be able to lecture in Hebrew within two years. Send curriculum vitae and two letters of reference. Contact: Chairman, Department of Economics and Business Administration, Bar Ilan University, 52100 Ramat Gan, Israel.

#413 UNIVERSITY OF SOUTH CAROLINA, Columbia, South Carolina, seeks applicants for Assistant, Associate, or Full Professor of Accounting or Tax. Candidates for Assistant Professor should have a doctoral degree or its equivalent. Teaching experience and publications represent added valuable credentials. Candidates for Associate Professor or Full Professor should have a record of quality teaching, and research, publications, and service activities consistent with the rank. The University of South Carolina is an equal opportunity/affirmative action employer. Interested persons should send a resumé to Dr. Gary A. Luoma, Accounting Program Director, College of Business Administration, University of South Carolina, Columbia, SC 29208.

#414 RICE UNIVERSITY, HOUSTON, TEXAS. The Jones Graduate School of Administration is seeking research oriented faculty with primary teaching interests in financial accounting to fill tenure-track positions at the level of Assistant/Associate professor beginning Fall 1989. A Ph.D. and evidence of high quality teaching research are required. Rice University is an Equal Opportunity/Affirmative Action Employer. Send vita; copies of recent articles, working papers, or a dissertation proposal, and student evaluations of teaching to Dr. Wilfred C. Uecker, Associate Dean for Academic Affairs, Jones Graduate School of Administration, Rice University, P.O. Box 1892, Houston, Texas 77251-1892. (713) 527-4869.

#415 THE SCHOOL OF ACCOUNTING, OKLAHOMA STATE UNIVERSITY, has one faculty vacancy at the associate professor rank. Appointments will be effective Fall 1989. Candidates should have the Ph.D. or D.B.A. and C.M.A. or C.P.A., strong quantitative research tools, an interest in research and writing, and be an effective classroom teacher. Oklahoma State University is an Equal Employment Opportunity/Affirmative Action Employer. Please send resumé to Lanny G. Chasteen, School of Accounting, College of Business Administration, Oklahoma State University, Stillwater, OK 74078-0555.

#416 RUTGERS UNIVERSITY, New Brunswick, The School of Business invites applications for tenure-track positions in accounting. Rank is open depending upon qualifications. A doctoral degree is preferred but ABD will be given serious consideration for the rank of Assistant Professor. An earned doctoral degree and established research record are required for all other ranks. Rutgers offers excellent teaching and research environments. Salary and fringe benefits are competitive. Rutgers is an equal opportunity/affirmative action employer. Interested candidates should send resumés to Professor Bikki Jaggi, Chairman, Department of Accounting, School of Business, Rutgers University, New Brunswick, New Jersey 08903.

#417 BUCKNELL UNIVERSITY invites applications for two anticipated tenure-track positions starting Fall, or possibly January, 1989. Successful candidates will be committed to excellence in teaching and have well developed scholarly interests. Ph.D. or DBA preferred. Related industry experience or professional certification is desirable. Salary and fringe benefits are very competitive. We seek a faculty member who is qualified to teach basic and advanced managerial accounting and management information systems with an emphasis upon management control systems. We also seek a faculty member whose primary teaching responsibilities will be in financial accounting. Address inquiries to: Dr. Stephen D. Willits, Department of Management, Bucknell University, Lewisburg, PA 17838. AA/EEO.

#418 THE UNIVERSITY OF ALABAMA IN HUNTSVILLE invites applications for tenure-track positions in Accounting to begin September 1989 or January 1989. Candidates with a Ph.D. or DBA degree, and good publication and teaching records are encouraged to apply for senior positions. Candidates with a new doctoral degree are encouraged to apply for assistant professor positions. ABD candidates may be considered. A CPA and/or CMA certificate and professional experience are preferred. Salaries are commensurate with qualifications and competitive with AACSB accredited universities. Preference will be given to candidates who apply by December 31, 1988. Contact Professor Grover L. Porter, Chairman, Department of Accounting, University of Alabama in Huntsville, Huntsville, Alabama 35899. Telephone 205-895-6159. UAH is an Affirmative Action/Equal Opportunity Institution.

#419 WAKE FOREST UNIVERSITY, The School of Business and Accountancy, invites applications for the position of Assistant or Associate Professor of Accounting to begin in January or September of 1989. All applicants should have a doctorate or be ABD with dissertation nearing completion. Candidates will be expected to teach undergraduate classes in financial accounting and/or systems. The School is fully accredited by the AACSB. Wake Forest is an AA/EEO employer. Send vita and names of references to Dean Thomas C. Taylor, School of Business and Accountancy, Wake Forest University, P. O. Box 7285, Reynolda Station, Winston-Salem, NC 27109.

#420 POSITION WANTED: Dynamic Ph.D. (in accounting) seeks opportunity to design and operate a large-lecture delivery system at your school for either introductory or intermediate accounting. Excellent teacher experienced in this format with good publication record. Available Fall 1989.

#421 UNIVERSITY OF MARYLAND (COLLEGE PARK) invites applications for a faculty position in Accounting. The minimum qualification for Assistant Professor is a Ph.D. degree. A candidate for Associate or Full Professor should have a distinguished publication record and a record of quality teaching. Interested candidates should send resumés to Professor Stephen E. Loeb, College of Business and Management, University of Maryland, College Park, MD 20742. The University of Maryland is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

#422 UNIVERSITY AT BUFFALO has a September 1989 opening for an Assistant or Associate Professor of Accounting. Teaching opportunities at undergraduate, M.B.A., and Ph.D. levels. Candidates for an Assistant Professor position should have a strong interest in research and possess relevant research tools, and have an earned doctorate or be in the advanced stage of dissertation research by September 1989. Candidates for an Associate Professor position should have a completed doctorate, an established research record, demonstrated teaching ability, and an ability to supervise doctoral students and work with junior faculty. Salary and fringe benefits are competitive. The University is an Affirmative Action/Equal Opportunity Employer. Please send resumé to Professor Lawrence D. Brown, 372 Jacobs Management Center, University at Buffalo, Buffalo, New York 14260.

#423 NORTH CAROLINA STATE UNIVERSITY invites applications for a tenure-track position in accounting beginning in the fall of 1989. An earned doctorate is required, although advanced ABDs will also be considered at the Assistant Professor level. Important qualifications include demonstrated interest in and ability to do publishable research, and a commitment to teaching excellence. Please send resumé to Paul F. Williams, Accounting Search Committee, Department of Economics and Business, North Carolina State University, Box 8109, Raleigh, North Carolina 27695-8109. North Carolina State University is an affirmative action/equal opportunity employer.

#424 SAN DIEGO STATE UNIVERSITY has one tenure-track opening, to begin Fall 1989, for an Assistant, Associate, or Full Professor in the area of financial accounting. If necessary, one-year or multi-year temporary employment may be available. SDSU is an EEO/AA employer. Please contact Robert Capettini, Director, School of Accountancy, San Diego State University, San Diego, California 92182. Telephone (619) 594-5310. A doctorate (or ABD) granted by a university with an AACSB accredited graduate program is required. CPA/CMA highly desirable. Deadline date: Open.

#425 THE UNIVERSITY OF MANITOBA is seeking applicants for tenure-track positions in accounting for July 1988. Rank is open, based on qualifications and experience. A visiting appointment is also possible. Ph.D. or DBA, completed or near completion is required. Duties include research and teaching at the undergraduate and graduate levels. Salary is competitive and will depend on qualifications, experience, and research record. Winnipeg, a multicultural city of 600,000, offers the best of an urban environment in the heart of Canada's vacation land. Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to qualified Canadian citizens and permanent residents of Canada. Applications should be sent to: DR. L. I. GOULD, HEAD, DEPARTMENT OF ACCOUNTING AND FINANCE, UNIVERSITY OF MANITOBA, WINNIPEG, MANITOBA, R3T 2N2.

#426 SAN JOSE STATE UNIVERSITY invites applications for tenure-track and temporary appointments in accounting. The areas of greatest need are accounting information systems, taxation, EDP auditing, and cost management systems. In evaluating applications, strong preference will be given to candidates who: demonstrate a record of teaching excellence; possess an appropriate doctorate from an AACSB accredited university (applicants for temporary appointments must possess an MBA or its equivalent); have a record of, and continuing interest in, research and publications; possess professional certification; have shown an ability to work as part of a team; and have excellent communication and interpersonal skills. Salary and rank dependent upon qualifications. Application review will continue until suitable candidates are found. Please contact Tom Black, Chair, Accounting Search Committee, Department of Accounting and Finance, School of Business, San Jose State University, San Jose, CA 95192-0066. Telephone (408) 924-3467. SJSU is an Equal Opportunity/Affirmative Action Employer.

#427 SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE. Applications are invited for a junior or senior faculty position in auditing, systems, or tax at the assistant, associate, or full professor level beginning September 1, 1988. A Ph.D. or DBA degree is required (ABD will be considered). The candidate considered for the senior position must have established record of outstanding research. The College is accredited by the AACSB, and the School of Accountancy has over 600 undergraduate and 40 graduate accounting majors. The College offers an MBA, M.Acc., and a DBA with an Accounting concentration. Salary is competitive dependent on candidate's qualifications/experience. Send resumé to Frederick H. Wu, Director, School of Accountancy, Southern Illinois University, Carbondale, Illinois 62901. SIU-C is an affirmative action employer. Deadline for application is November 15, 1988.

#428 THE UNIVERSITY OF MICHIGAN-FLINT has openings for tenure-track faculty positions at all ranks starting in either September or January. Most interest areas can be accommodated, although preference will be given to candidates in auditing and accounting information systems. Professional certification is desirable. Responsibilities include quality teaching, research, and service. Candidates must have a doctorate or be in the last stages of ABD. Salary is competitive and fringe benefits are excellent. Candidates should send a resumé to: Dean Richard W. Fortner, School of Management, The University of Michigan-Flint, Flint, MI 48502-2186. Applications accepted until position is filled. AA/EOE.

#429 SAN FRANCISCO STATE UNIVERSITY has tenure-track faculty openings in financial accounting, auditing, and taxation. Experienced faculty are especially needed in auditing and taxation to help implement and coordinate courses and programs in these areas. An appropriate doctoral degree or ABD status, professional experience and/or certification are required. Faculty are expected to engage in instructional and professional activities, and research; major emphasis is on teaching effectiveness. Salary and rank dependent upon qualifications. The School of Business is accredited by the AACSB at both the undergraduate and graduate levels. Send vita to Dr. Steven M. Mintz, Chair, Department of Accounting, School of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, California 94132. Closing date for applications is February 15, 1989. San Francisco State University is an equal opportunity/affirmative action employer.

#430 COLLEGE OF MANAGEMENT, THE UNIVERSITY OF MASSACHUSETTS AT BOSTON seeks applicants for accounting faculty positions. Candidates should hold Ph.D. or D.B.A. in Accounting; ABD's nearing completion will also be considered. Rank and salary are dependent on qualifications. CPA, CMA, or CIA would be a plus. The campus has modern facilities and is located at Boston Harbor. The College offers undergraduate and MBA programs, and emphasizes quality instruction and research. Salary, teaching load, and other benefits are very competitive. Apply by 10/15/88 to Dr. Lal C. Chugh, Chairman, Department of Accounting and Finance, College of Management, University of Massachusetts/Boston, Boston, Massachusetts 02125. The University is an equal opportunity/affirmative action employer. Minorities and women are encouraged to apply.

#431 THE UNIVERSITY OF CONNECTICUT has a Fall 1989 accounting faculty opening. Candidates for Assistant Professor should have a doctorate or have completed everything but the dissertation as of the Fall of 1989, while Senior faculty must have an established research record in addition to the doctorate. The Accounting Department is accredited by the AACSB at the bachelors and masters levels. In the Fall of 1987 a new doctoral program started. Primary consideration will be given to those with an interest in managerial accounting. The University of Connecticut is an Equal Employment Opportunity/Affirmative Action Employer. Contact: Dr. Harold E. Wyman, Department Head, Accounting Department, Box U-41A, 368 Fairfield Road, The University of Connecticut, Storrs, CT 06268. Telephone (203) 486-3019.

#432 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August, 1989, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold a doctoral degree with specialization in accounting; professional experience and/or certification are desirable. Primary emphasis is on teaching effectiveness; research and scholarly activities are required. Applicants in final stages of doctoral study may be considered for nontenure-track positions that may be converted to tenure-track if the doctorate degree is completed during the term of appointment. Send application letter and resumé to Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. The Department will begin to review applications on Friday, September 30, 1988 until each position is filled. CSU, Sacramento is an Equal Opportunity/Affirmative Action/Handicapped/Title IX/Vietnam ERA Veteran Employer.

#433 TRENTON STATE COLLEGE ACCOUNTING FACULTY POSITION SEPTEMBER, 1989. Tenure-track position available to teach auditing and other upper-level accounting courses. Appropriate Ph.D. required for tenure, doctoral candidates invited to apply. CPA and/or professional audit experience desirable. Reduced teaching load and reasonable research expectation in small department dedicated to quality teaching and close faculty-student interaction. Apply by November 1, 1988 to Dr. Barbara J. Shiarappa, Chairperson, Department of Accounting, School of Business, CN 4700, Hillwood Lakes, Trenton, NJ 08650-4700. Minorities and women are encouraged to apply. AA/EOE.

#434 ENDOWED PROFESSORSHIP IN ACCOUNTING. UNIVERSITY OF HOUSTON-DOWNTOWN. The holder of this Fiesta Mart Professorship will be expected to teach, publish, and provide leadership in the Accounting program, including curriculum, faculty development, and interaction with the business community. PhD or DBA with a specialization in Accounting and an established record of research, publication, and excellence in teaching. Dr. Stan Ebner, Dean of Business, University of Houston-Downtown, Houston, Texas 77002. CHAIR OF FINANCE, ACCOUNTING & COMPUTER INFORMATION SYSTEMS DEPARTMENT, UNIVERSITY OF HOUSTON-DOWNTOWN. PhD or DBA in appropriate field. Record of publications, excellent teaching, and working with business and professional groups. Demonstrated leadership ability. Familiarity with AACSB accreditation process. Leadership experience in AACSB accreditation preparation preferred. Start date is August, 1989. Dr. Stan Ebner, Dean of Business, University of Houston-Downtown, Houston, Texas 77002.

#435 CHAIRPERSON, COLORADO STATE UNIVERSITY, position available June 1989. Chairperson provides academic and administrative leadership for a 14-member College of Business department. College has full AACSB accreditation graduate and undergraduate levels. Chairperson has 10½-month contract. Teaching assignments include undergraduate—or graduate-level courses. Must qualify for rank of full professor; Ph.D., DBA, or J.D. required; professional certification desirable; research and scholarly writing is expected as is commitment to excellence in teaching. Administrative experience preferably within a department of accounting. Salary open, competitive, based upon qualifications. Deadline February 28, 1989. Send resumé, three references, short statement of views of the role of department chairperson to Dr. R. V. Switzer, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523.

#436 POSITION WANTED: PhD, CPA. Eighteen years teaching experience, publications. Prefer urban location. Available Fall, 1989.

#437 UNIVERSITY OF MIAMI. The department of accounting has openings for faculty at the assistant, associate, or professor levels. Applicants for the latter two ranks should have a demonstrated record of excellence in research and teaching while assistant level applicants should show promise of excellence. ABD applicants nearing completion will be considered. We are an equal opportunity employer. Contact Professor Frank Collins, School of Business, University of Miami, Box 248031, Coral Gables, FL 33124.

#438 YALE UNIVERSITY SCHOOL OF MANAGEMENT. Yale's graduate School of Management is seeking a number of additional junior faculty members in the areas of Accounting, Economics, Finance, Marketing, and Production. Ph.D. or equivalent is required, research and teaching interest in application and theory preferred as well as interdisciplinary orientation. Appointments will be made for the 1989–90 year. By December 15, 1988, please send resumé, references, and an example of scholarly work to: Professor Merton J. Peck, Acting Dean, Faculty Recruiting, Yale School of Management, Box 1A Yale Station, New Haven, CT 06520-7368. Yale is an equal opportunity, affirmative action employer.

#439 THE UNIVERSITY OF DELAWARE, Department of Accounting, is recruiting an accounting information systems person capable of both quality research and teaching. A Ph.D. or DBA in Accounting is required. We consider ourselves to be a "balanced" college and university where teaching and research are rated equally. We have a high quality undergraduate student population, an AACSB accredited undergraduate program, an MS in Accounting program, a dedicated faculty, reasonable research expectations, very good professional relationships, and opportunities in a suburban/rural east coast living environment. The University of Delaware is an equal opportunity employer which encourages applications from minority groups and women. Please contact: CHAIRPERSON–DEPARTMENT OF ACCOUNTING, College of Business & Economics, University of Delaware, Newark, DE 19716 (302-451-2961).

#440 PURDUE UNIVERSITY. Applicants are invited for positions in accounting at both the junior and senior levels for appointments beginning in August 1989 or January 1990. We are particularly interested in appointing a person as a senior associate professor or as a new full professor. A Ph.D. or D.B.A. degree is required. Candidates for appointment as assistant professor must exhibit capacity for quality research and teaching. Candidates for appointment as associate or full professor must have a record demonstrating excellence in research and teaching. Resumés should be sent, before March 15, 1989, to Professor Robert Eskew, School of Management, Purdue University, West Lafayette, Indiana 47907. Telephone 317-494-4469. Purdue University is an Affirmative Action/Equal Opportunity Employer.

#441 ACCOUNTING FACULTY, Virginia Commonwealth University is seeking three tenure-track faculty members for Fall 1989. Applicants are required to have an appropriate doctorate or be nearing completion. An interest in Taxation, Auditing, or Accounting Information Systems as well as a professional certificate and experience are preferred. Applicants for senior rank should have an established record of performance in research. Send inquiries to Chairman, Department of Accounting, VCU, Richmond, VA 23284-4000. Review of applications will begin on November 1, 1988 and continue until all positions are filled. VCU is an Equal Opportunity/Affirmative Action Employer and strongly encourages the application of minorities and women.

#442 PORTLAND STATE UNIVERSITY invites applications for appointment in the Department of Accounting. The position is at Assistant or Associate level. Research and teaching in taxation or accounting required. Applicants should possess a doctoral in accounting or other terminal qualification for teaching. Advanced dissertation stage candidates considered. Performance evaluation based upon teaching, research, publication, and university and community service. Programs offered at undergraduate and graduate levels. The department's relationship with the professional accounting community is excellent. Send vita to Dr. Michael R. Gaines, Head, Department of Accounting, Portland State University, Portland, Oregon 97207-0751. Application deadline is November 15, 1988, or until position is filled. PSU is an equal opportunity, affirmative action employer. Minorities, women, and members of other protected groups are encouraged to apply.

#443 THE UNIVERSITY OF ALABAMA School of Accountancy has openings for accounting faculty, beginning August 1989. Applicants will be considered at all ranks, including permanent and visiting, tenure-track and temporary. Applicants for tenure-track positions should possess a doctorate or be in the final stages of a doctoral program and should demonstrate potential for quality research. Enquiries should be sent to: Robert W. Ingram, Director, School of Accountancy, Drawer AC, University of Alabama, Tuscaloosa, AL 35487. An equal opportunity, affirmative action employer.

#444 LA SALLE UNIVERSITY seeks applications for two tenure-track positions at Assistant/Associate level. Ph.D. in accounting. ABD near completion also considered. Nine-hour teaching load (two preparations) in MBA and undergraduate programs. We seek persons with balanced commitment to excellence in teaching and research. Strong institutional support for both including office and classroom micros, COMPUSTAT/CRSP. Informal participatory environment where your involvement is sought. Accounting Department has 500 majors and 13 full-time faculty. La Salle is a 125-year-old private institution with 6,500 students. Send resumé to: Joseph Markmann, Chairman, Accounting Department, La Salle University, Philadelphia, PA 19141. EEO/AA Employer.

#445 FRANKLIN AND MARSHALL COLLEGE invites applications for a tenure-track accounting position beginning Fall, 1989, at the assistant professor or instructor rank, depending on receipt of doctorate degree. Primary focus in area of cost and managerial accounting. Earned doctorate or ABD, teaching and business experience desirable. Balanced emphasis on teaching and research. Franklin and Marshall College is a private residential coeducational liberal arts college located in Lancaster, PA and enrolling 1,850 undergraduates. The business administration program is integrated into the liberal arts curriculum. Vitas, including letters of reference and all transcripts should be directed to: Professor Samual Wagner, Chair, Department of Business Administration, Franklin and Marshall College, P.O. Box 3003, Lancaster, PA 17604-3003. EOE.

#446 BUSINESS ADMINISTRATION—Tenure-track position for 1989–90, preferably at assistant or associate professor level; Ph.D. or D.B.A. required for tenure consideration. Teaching responsibilities to include undergraduate accounting courses. Candidates should enjoy teaching, relate well to students, and appreciate mission of a liberal arts college. Numerous opportunities for research, internship supervision, and consulting in nearby Dallas. Send dossier (transcript(s)) and at least three current letters of recommendation by November 1 to Dean David Jordan, Austin College, Sherman, Texas 75091. EOE.

#447 THE UNIVERSITY OF SOUTHERN MAINE. The Department of Accounting is seeking applicants for a tenure-track position available for September, 1989. Candidates should possess a doctorate in accounting, though ABD's nearing completion will be considered. Teaching responsibilities will include auditing or systems along with financial accounting. Teaching effectiveness is emphasized along with expectations of scholarly research. Competitive salary and benefits. USM is a growing, dynamic university located in Maine's largest city, less than two hours north of Boston. Applicants should forward vita to: Dr. George Violette, Chairman, Search Committee, Department of Accounting, University of Southern Maine, 96 Falmouth Street, Portland, ME 04103. USM is an EEO/AA employer.

#448 SAN DIEGO STATE UNIVERSITY has three non-tenure track openings at its NORTH COUNTY CAMPUS, for a three-year-period beginning Fall 1989, for Assistant, Associate, or Full Professors in the areas of financial accounting, managerial accounting, and auditing. These FULL TIME positions offer the challenge not only to teach but also to participate in the development of a new campus in the fast growing area of north San Diego County. SDSU is an EEO/AA employer. Please contact Robert Capettini, Director, School of Accountancy, San Diego State University, San Diego, CA 92182; telephone (619) 594-5310. A doctorate granted by a university with an AACSB accredited graduate program is required. CPA/CMA are highly desirable. Deadline date: open.

#449 UNIVERSITY OF MINNESOTA'S ACCOUNTING DEPARTMENT invites applications for Assistant Professor of Accounting. Other ranks considered, subject to applicant's qualifications and department needs. Visiting position considered. Applicants should possess a Ph.D. or expect soon. If Ph.D. is not completed, rank of instructor will be assigned until Ph.D. completed. Responsibilities include research, service, and teaching. Pools will be formed. Applications must be received prior to March 1, 1989 for permanent position; prior to May 1, 1989 for visiting position. The University of Minnesota is an equal opportunity educator/employer, encouraging applications from women and minorities. Send application and vita to Gordon L. Duke, Chairman of Recruiting, Accounting Department, Carlson School of Management, University of Minnesota, 271–19th Avenue South, Minneapolis, MN 55455-0413. 612-624-6506.

#450 UNIVERSITY OF ILLINOIS, Department of Accountancy, invites applications at all ranks in accounting. Candidates are expected to possess a doctoral degree or be near completion of degree and should be dedicated to excellence in teaching and research. The University of Illinois is an equal opportunity, affirmative action employer. Please send vita to Lawrence A. Tomassini, Head of Department, Department of Accountancy, University of Illinois, 360 Commerce West, 1206 S. Sixth Street, Champaign, IL 61820. Telephone (217) 333-2451.

#451 TEXAS TECH UNIVERSITY invites applications for a permanent faculty position in Accounting beginning Fall 1989. The position will be available at the assistant rank for teaching and research interest in financial accounting, systems, and/or auditing. Doctorate required. Certification desirable. Competitive salaries commensurate with experience and education. Texas Tech offers accounting programs at the undergraduate, masters, and doctoral levels. Apply to Professor Gary E. White, College of Business Administration, Texas Tech University, P.O. Box 4320, Lubbock, Texas 79409. Affirmative Action/Equal Opportunity Employer.

#452 EASTERN NEW MEXICO UNIVERSITY announces tenure-track positions in Accounting or Computer Information Systems. Rank is dependent upon candidate's qualifications. Ph.D. or DBA with professional certification preferred. Candidates must be effective teachers with an earnest commitment to scholarship and service. Send letter of application and resumé including names of three references to Dr. Leslie R. Loschen, Chair, Department of Accounting/Computer Information Systems, ENMU, #49, Portales, NM 88130. ENMU hires only U.S. citizens and aliens lawfully authorized to work in the U.S. and is an AA/EOE.

#453 NORTHERN ILLINOIS UNIVERSITY expects to have openings for accounting faculty starting August, 1989. All ranks and fields will be considered, but likely openings will be in systems and taxation. Terminal degree required, but ABD's will be considered at the assistant level. CPA or other certification desirable. NIU faculty are committed to excellent teaching, professional involvement, and professional research. Interested applicants should send resumé to John Smith, Chair, Department of Accountancy, Northern Illinois University, DeKalb, IL 60115. Northern Illinois University is an Equal Opportunity, Affirmative Action Employer.

#454 THE UNIVERSITY OF WISCONSIN-MILWAUKEE is seeking a tenure-track, Assistant Professor of Accounting for Fall 1989. All areas considered with particular needs in financial or managerial accounting. Candidates should possess a PhD degree, or be near completion. Summer teaching and research opportunities. Salary is competitive. Letter of application and resumé to Dr. Paul M. Fischer, School of Business Administration, University of Wisconsin-Milwaukee, P.O. Box 742, Milwaukee, WI 53201. UWM is an Affirmative Action/Equal Opportunity Employer and is seeking applications from all qualified applicants, especially minorities and women.

#455 THE UNIVERSITY OF SOUTH FLORIDA is seeking highly qualified faculty members to teach undergraduate and graduate level courses in accounting. These positions are at the instructor, lecturer, assistant professor, associate professor, and professor rank. Those considering the professorial rank positions must have demonstrated interest in, and leadership capacity to do publishable research and a high level of competence in teaching graduate-level courses in the Master of Accountancy and Ph.D. programs. The University of South Florida is an Affirmative Action/Equal Opportunity Employer. Please send vita to Robert J. West, Director, School of Accountancy, College of Business Administration, University of South Florida, Tampa, FL 33620-5500.

#456 INDIANA STATE UNIVERSITY, Department of Accounting, announces an opening for position of Chairperson. Candidate should have the following qualifications: doctorate in accounting; established record in research and publication with excellent teaching reputation; history of working effectively with the professional community and business organizations; CPA and/or CMA certification; administrative experience desirable, particularly with AACSB accredited accounting program; previous business experience desirable. Salary is competitive. Send complete application including resumé, references, and publication record to Dr. John Cooley, Associate Dean, School of Business, Indiana State University, Terre Haute, Indiana 47809. 812-237-2000. Deadline November 15, 1988 or until filled. Indiana State University is an Equal Opportunity/Affirmative Action Employer. Minorities and women are encouraged to apply.

#457 POSITION DESIRED—Ph.D., CPA. Twelve years teaching experience in undergraduate and graduate accounting information systems auditing. Strong teaching evaluations. Numerous publications in various professional journals. Geographic preference—eastern half of the United States. Available Fall 1989.

#458 LOYOLA MARYMOUNT UNIVERSITY (LMU) invites applications for tenure-track positions in Financial and Managerial Accounting. Rank and salary depend on experience. Completed doctorate in accounting is required. Evidence of effective teaching will be sought. It is expected that you are capable and willing to engage in research. Our undergraduate accounting program is one of the most highly regarded in Los Angeles. LMU is located near the ocean and the airport, convenient to all of the city's business centers. Please contact Dr. Alan Cherry, Department of Accounting, College of Business, LMU, Los Angeles, CA 90045. An Equal Opportunity, Affirmative Action Employer.

#459 FLORIDA ATLANTIC UNIVERSITY is seeking applicants for both entry-level assistant professors (doctorate, professional certifications desired; will consider ABD) and "heavy" assistant or "light" associate professors (doctorate, professional certifications, moderate publication record, good classroom skills, continuing interest in research, and working with graduate students). Campuses in Boca Raton, Fort Lauderdale, and West Palm Beach. Send vita to Dr. Robert Taylor, Director, School of Accounting, FLORIDA ATLANTIC UNIVERSITY, Boca Raton, Florida 33431. Affirmative Action/Equal Opportunity Employer.

#460 INDIANA STATE UNIVERSITY is seeking a faculty member in Accounting for a tenure-track position beginning August 1989. Teaching interests may be in the Financial, Auditing, or Income Tax/Business Law areas. Earned doctorate with CPA or CMA certification is preferred; ABDs will be considered. A JD with masters (Law or Accounting) with CPA will be considered for tax/business law area. All interested parties are encouraged to apply. Send resumé to Dr. Henry Longfield, Chairman, Department of Accounting, Indiana State University, Terre Haute, Indiana 47809. Indiana State is an equal opportunity/affirmative action employer.

#461 STEPHEN F. AUSTIN STATE UNIVERSITY anticipates tenure-track positions for the Fall 1989 semester. Preferred level of appointment is at the assistant level, but appointments will be considered at any rank dependent upon qualifications. Earned doctorate is preferred, advanced ABDs will be considered. Professional certification is desirable. SFASU is a 12,500 student body, state-supported university located in Nacogdoches, Texas, 130 miles north of Houston and 160 miles southeast of Dallas. The School of Business Administration is AACSB-accredited with approximately 4,000 majors. The Department of Accounting has 700 majors with 15 full-time faculty. Interested candidates are invited to submit their resumé to Professor Sammie L. Smith, Chairman, Department of Accounting, Stephen F. Austin State University, Nacogdoches, TX 75962. SFASU is an EO/AA employer.

#462 DEPARTMENT HEAD AND PROFESSOR: THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO is conducting an external search for a head for the Department of Accounting starting August 1, 1989. The head provides leadership to 12 full-time faculty. Applicants should have a Ph.D. with a proven record of excellence in teaching and research. Appointee must qualify for full-professor rank with tenure. The Department offers a B.S. with an accounting major, a Master of Science degree program in Accounting and service courses for an MBA program. Salary is competitive. Candidates should send a resumé to Dr. Charles J. Woelfel, Chair, Accounting Chairperson Search Committee, Bryan School of Business and Economics, the University of North Carolina at Greensboro, Greensboro, NC 27412. Application deadline is December 1, 1988. The University of North Carolina is an Equal Opportunity, Affirmative Action Employer. Minorities and women are encouraged to apply.

#463 ACCOUNTING—ASSOCIATE AND FULL PROFESSOR—Doctorate in Accounting. Must have teaching experience, demonstrated research and publications record, and active professional involvement. Must be strongly involved in the area of taxation, financial, or managerial accounting. ASSISTANT PROFESSORS—Doctorate in Accounting or completion of all requirements by employment date. Will consider only persons with interest in teaching and research in taxation, financial, or managerial accounting. Starting Date: Fall Quarter, 1989. Salary: Competitive. Application Deadline: November 1, 1988. To Apply: Send resumé to Dr. Leonard Eugene Berry, Director, School of Accountancy, Georgia State University, University Plaza, Atlanta, Georgia 30303.

#464 THE UNIVERSITY OF ALABAMA SCHOOL OF ACCOUNTANCY invites applications and nominations for the Ernst & Whinney Professorship. Candidates should have a record of scholarly research and excellence in teaching, as well as an interest in interacting with the profession. The Ernst & Whinney Professor will be expected to contribute significantly to the research and teaching activities of the faculty and to become involved with the doctoral program. Compensation will be highly competitive. Applications and nominations should be sent to Professor Mary Stone, Chairperson, Ernst & Whinney Professor Search Committee, University of Alabama, Drawer AC, Tuscaloosa, Alabama 35487-1399. The deadline for applications is November 1, 1988, or until the position is filled. The University of Alabama is an equal opportunity/affirmative action employer.

#465 THE UNIVERSITY OF NORTHERN IOWA seeks applications for the position of Head, Department of Accounting. Requires Ph.D./DBA in accounting with a teaching/scholarly record commensurate with a senior appointment. Leadership capabilities in teaching, research, and professional development required. Salary competitive. Benefits attractive. The Department offers BA programs and MBA courses involving ten full-time faculty and 1,000 undergraduate majors. The undergraduate accounting program is nationally recognized for its excellence. The University of Northern Iowa is an Equal Opportunity/Affirmative Action Employer. Women, minorities, and members of other protected classes are encouraged to apply. Nominations and applications, resumé, and names of three references to: Tony McAdams, Chair, Accounting Head Search Committee, 133 Seerley Hall, University of Northern Iowa, Cedar Falls, IA 50614-0125.

#466 LOYOLA COLLEGE IN MARYLAND has tenure-track Assistant/Associate positions open for September 1989. We are recruiting committed, qualified people to teach in the financial, managerial, auditing, or accounting information systems areas. Candidates are expected to possess a doctoral degree or be near completion of the degree; professional certification desirable. Faculty teach in undergraduate and graduate programs (MBA and Executive MBA) with assignments dependent on applicant's interests and qualifications. Research and publications required and supported. Salary is competitive. Loyola's business programs have AACSB accreditation; currently applying for AACSB accounting accreditation. Please send vita to: William E. Blouch, Recruiting Coordinator, Department of Accounting, Loyola College, 4501 N. Charles Street, Baltimore, MD 21210. EEO/AAE.

#467 CALIFORNIA STATE UNIVERSITY, STANISLAUS seeks faculty in Accounting at assistant or associate professor level depending on qualifications. Undergraduate and MBA programs. Teaching excellence, scholarship, and professional activity required. Doctorate required or close. CPA/professional certification desirable. Financial accounting desired for one position. Academic calendar includes a one-month winter term providing opportunity for innovative teaching/research. Located in the San Joaquin Valley in a small city, 15 miles to Modesto. Two-hour drive to San Francisco/High Sierras, three hours to Lake Tahoe. Cal State Stanislaus is an Affirmative Action/Equal Opportunity/Title IX/Section 504 employer. Citizens/permanent residents only. Direct applications to: Dr. Gerald E. Nichols, Chairman, Department of Accounting and Finance, School of Business Administration, California State University, Stanislaus, Turlock, CA 95380. 209-667-3671.

#468 THE UNIVERSITY OF AKRON, Department of Accounting, is AACSB accredited at the undergraduate and graduate level. Applications invited for tenure-track positions as Assistant Professor of Accounting (other ranks subject to qualifications), beginning Fall 1989. Doctorate Ph.D. or DBA/professional certification are desired. ABDs also invited to apply. Candidates should be committed to excellence in teaching/scholarly productivity. Will accommodate most teaching areas; preference given to candidates in financial, auditing/systems/taxation. Department of Accounting offers BS, MBA, and Master of Taxation degrees. Contact Dr. Richard W. Metcalf, Head, Department of Accounting, Akron, OH 44325. Consideration given to all vitas received by January 31, 1989. Women and minorities encouraged to apply. The University of Akron is an Equal Education and Employment Institution.

#469 CHAIRPERSON, DEPARTMENT OF ACCOUNTING, Illinois State University, beginning July 1, 1989. Qualifications: earned doctorate, preferably in accounting; administrative experience; and record of scholarship and teaching to warrant appointment as Associate or Full Professor. Applications will be accepted until position is filled, but to assure consideration, submit letter of application and vita by October 31, 1988 to: Dr. V. Jean Ramsey, Search Committee Chairperson, 329 Williams Hall, Illinois State University, Normal, Illinois 61761. EEO/AA employer.

#470 ARIZONA STATE UNIVERSITY is seeking applicants for tenure-track position at the Assistant, Associate, and Full Professor rank for 1989-90. Financial accounting is our primary need, but others will be considered. Assistant position requires an earned doctorate or in final stages of dissertation and a commitment to research and publication as well as teaching. Associate and Full Professor applicants must have an earned doctorate and an established record of recent and continuing research and quality teaching. This announcement will remain open until positions are filled. Send vita to Ralph Smith, Chair, Faculty Recruiting Committee, School of Accountancy, College of Business, Arizona State University, Tempe, AZ 85287-3606. Arizona State University is an Equal Employment Opportunity/Affirmative Action Employer.

#471 GEORGIA SOUTHERN COLLEGE is seeking applicants for an anticipated tenure-track position at the rank of Assistant/Associate Professor starting Fall 1989. Ph.D. or D.B.A. preferred; ABD considered. CPA or CMA highly desirable. Application deadline: January 1, 1989. Send letter of application and resumé to Dr. William J. Bostwick, Department of Accounting, L.B. 8141, Georgia Southern College, Statesboro, GA 30460. GSC is an AA/EEO employer.

#472 CHAIRPERSON, Department of Accounting, University of Nevada, Las Vegas. There are 14 faculty, 600 undergraduate majors; MS and MBA Programs. Applicants must have an earned doctorate in accounting from an AACSB accredited school and a record of recent and continuing research appearing in national publications. Demonstrated ability to provide academic and administrative leadership to a growing accounting department is desirable. Send resumé, letter of application, and three letters of reference to: Dr. W. T. Cummings, College of Business and Economics, University of Nevada, Las Vegas, Las Vegas, Nevada 89154. Review of applications will begin on October 1, 1988 and continue until position is filled. AA/EEO employer.

#473 THE UNIVERSITY OF AUCKLAND, NEW ZEALAND, Department of Accounting and Finance invites applications for tenure-track, contract, and visiting appointments for the 1989 academic year. Candidates should possess a higher degree, preferably a doctorate. The Department offers an undergraduate degree with a major in accounting and/or finance; Master of Commerce degree; MBA and a postgraduate Diploma in Finance. Also, there is a small Ph.D. program. Visiting appointments may suit staff applying for leave from own institutions. Minimum visit time twelve weeks. Could be aligned with U.S./Canadian summer vacation periods. Rank and salary contingent upon experience/qualifications. Send resumé to David M. Emanuel, Head, Department of Accounting and Finance, University of Auckland, Private Bag, Auckland 1, New Zealand.

#474 THE UNIVERSITY OF MICHIGAN-DEARBORN, School of Management, invites applications for accounting positions, available January or September 1989. Rank through Associate Professor available to candidates possessing a PhD/DBA, with CPA/CMA preferred; ABD's considered. The successful applicant will be dedicated to quality teaching, research, and service activities. Department leadership potential for interested candidates. Apply to Gail McCracken, Assistant Dean, School of Management, The University of Michigan-Dearborn, Dearborn, MI 48128-1491. Posting remains open until positions are filled. The University of Michigan-Dearborn is an equal opportunity educator and employer and specifically encourages women and minority applicants.

#475 SOUTHEAST MISSOURI STATE UNIVERSITY is seeking qualified faculty in Accounting. Qualifications: a doctorate in Accounting, classroom excellence, professional growth potential, and ability to relate to students, faculty, and business community. Certification (CPA/CMA) is desirable. Compensation is competitive. The Department has an especially strong program with approximately 550 majors. Cape Girardeau is a "Best Town in America" with a population of 35,000. Review of applicants begins October 1, 1988; open until filled. Send vita to Dr. Keith A. Russell, Chairperson, Department of Accounting & Finance, Southeast Missouri State University, Cape Girardeau, MO 63701. The University is an equal opportunity/affirmative action employer.

#476 APPALACHIAN STATE UNIVERSITY seeks outstanding person to serve as Chairperson of the Department of Accounting. Qualifications include appropriate doctorate, demonstrated competency in teaching, research, and public relations. Proven administrative and leadership ability, public/industrial accounting experience, and certification preferred. Position available July 1, 1989. Complete applications due by November 4, 1988, must include letter of application; current resumé; names, addresses, and phone numbers of at least three references; and any additional material the applicant wishes to furnish. Official transcripts required prior to appointment. Send applications to: Jim Jones, Chairperson Search Committee, Accounting Department, Appalachian State University, Boone, NC 28608. ASU is an Equal Opportunity Employer.

#477 EMORY UNIVERSITY, Atlanta, GA, invites applications from qualified individuals for a tenure-track position with primary teaching responsibilities in financial accounting effective August, 1989. Candidates should have an earned doctorate by the date of appointment and have a proven record or strong potential for both quality teaching and research. An interest in executive education programs is desirable. Emory is an Equal Opportunity/Affirmative Action employer and careful consideration will be given to female and minority group applicants. Please send vita or inquiry to: Professor James A. Gentry, Jr., Emory Business School, Atlanta, GA 30322.

#478 ASSISTANT/ASSOCIATE PROFESSORS, SCHOOL OF BUSINESS AND ENGINEERING ADMINISTRATION, MICHIGAN TECHNOLOGICAL UNIVERSITY. Applications are invited for positions of Assistant Professor and Associate Professor. MTU is a state-supported technologically-oriented institution. Candidates should hold an earned doctorate in Accounting. Candidates at the all-but-dissertation stage of their doctoral programs are also invited to apply. Professional certification and/or relevant professional experience is desired. The successful candidate will teach at the undergraduate and graduate levels. Summer quarter teaching and research opportunities available. Salary competitive. Send applications/enquiries to: William B. Chapel, Recruiting Committee, School of Business and Engineering Administration, Michigan Technological University, Houghton, MI 49931. Michigan Technological University is an Equal Opportunity Educational Institution/Equal Opportunity Employer.

#479 INDIANA UNIVERSITY SOUTHEAST invites applications for the position of Assistant or Associate Professor of Accounting. DBA/PhD required; CPA, CMA, or other professional designation preferred. IUS, an AACSB accredited campus of Indiana University, is located in the Louisville, Ky. Metropolitan area (population nearly one million). The University offers faculty a small campus atmosphere (4,800 students) with resources of a large university system. Applications received before November 15, 1988 will be assured consideration. Send resumé and credentials to: Professor William Riggs, Division of Business/Economics, Indiana University Southeast, New Albany, IN 47150. An Equal Opportunity/Affirmative Action Employer.

#480 THE UNIVERSITY OF NEBRASKA AT OMAHA invites applicants for tenure-track positions in accounting. Interest areas are financial and managerial accounting. Rank and salary commensurate with qualifications. An earned doctorate (ABD considered) and potential for scholarly research, teaching, and professional service activities are expected; professional certification desirable. The department offers both MPA and undergraduate programs. Applications accepted until positions filled. Contact Professor Michael J. Barrett, Chair, Professional Accounting Department, College of Business Administration, The University of Nebraska at Omaha, Omaha, Nebraska 68182-0047. (402) 554-2807. AACSB Accredited. Equal Opportunity/Affirmative Action Employer.

#481 TAX. Full-time, permanent faculty (financial and tax), graduate and undergraduate courses, Fall, 1989. PhD or JD, MBA (Accounting Concentration), CPA; PhD or JD, LLM (Tax), CPA with solid tax publication record. ABD considered. Teaching continuing education courses in taxation experience desirable. Research/scholarly writing essential for promotion and tenure. Rank open. Preference to Assistant Professor. Salary competitive. A land-grant University in a progressive city of 80,000+. Submit resumé, transcript, and three letters of recommendation to: Dr. Terry L. Lantry, Interim Chairman, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523. Deadline: February 28, 1989. Search may be extended until filled. Position contingent on availability of funds. An Equal Opportunity, Affirmative Action employer.

#482 ACCOUNTING. Full-time, permanent faculty (financial and auditing), graduate and undergraduate courses, Fall, 1989. PhD or DBA required. ABD considered. Research or scholarly writing essential for promotion and tenure. Rank open. Preference to Assistant Professor. Salary is competitive. A land-grant University located in a progressive city of 80,000+. Applicants should submit a resumé, transcript, and three letters of recommendation to: Dr. Terry L. Lantry, Interim Chairman, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523. Application deadline February 28, 1989. Search may be extended until filled. Position contingent on the availability of funds. An Equal Opportunity, Affirmative Action employer.

#483 ROCHESTER INSTITUTE OF TECHNOLOGY invites applications for Department Chair of Accounting. Candidates must have an appropriate doctorate and a strong teaching and publication background. Administrative experience desirable. Salary and benefits are competitive. RIT is a privately endowed, coeducational university serving 14,000 students in suburban Rochester, New York, home to a full range of cultural, educational and social activities, and a high technology industrial base. The College of Business is AACSB accredited, has approximately 1,700 undergraduate and graduate students, and 42 faculty. The Department of Accounting consists of eight tenure-track positions. Send applications to: Dr. Bruce L. Oliver, Department of Accounting, RIT College of Business, Rochester, NY 14623. EOE/AA.

#484 ROCHESTER INSTITUTE OF TECHNOLOGY invites applications for tenure-track faculty positions. Candidates seeking Assistant positions should have an appropriate doctorate or be near completion. Associate/Full candidates must also possess strong publication background. Salary and benefits are competitive. RIT is a privately endowed, coeducational university serving 14,000 students in suburban Rochester, New York, home to a full range of cultural, educational and social activities, and a high technology industrial base. The College of Business is AACSB accredited, has approximately 1,700 undergraduate and graduate students, and 42 faculty. Send applications to: Dr. Bruce L. Oliver, Department of Accounting, RIT College of Business, Rochester, NY 14623. EOE/AA.

#485 UNIVERSITY OF LOUISVILLE: Assistant, Associate, or Professor of Accountancy. The successful candidate will have experience in the horse industry or a strong interest in developing expertise through teaching, research, and interaction with the equine community. Preference will be given to candidates with documentable experience and the ability to bring that experience to the classroom. A doctorate is preferred but ABD to be completed by December 1988 is acceptable. This is a tenure-track position. Contact Dr. Robert Lawrence, Director, Equine Industry Program, University of Louisville, School of Business, Louisville, KY 40292. (502) 588-7617. The University of Louisville is an Equal Opportunity/Affirmative Action Employer.

#486 ARTHUR ANDERSEN & CO./DUANE R. KULLBERG CHAIR IN ACCOUNTING AND INFORMATION SYSTEMS. Department of Accounting, Carlson School of Management, announces the creation of and solicitations for this prestigious Chair. Chair is expected to promote natural research intersections between financial/managerial, accounting/management information systems; provide research leadership; engage in research promoting better accounting information systems; understanding value of information, costs/benefits of alternative systems, and uses by today's managers. Engage in research with PhD students; teach in one or all of degree programs. Qualifications: Doctorate in Accounting/Research record with standards for Full Professor. Salary competitive. Submit resumé or nominations by November 30, 1988 to David A. Dittman, Department of Accounting, Carlson School of Management, University of Minnesota, Minneapolis, MN 55455.

#487 CURTIS L. CARLSON CHAIR IN ACCOUNTING and the CURTIS L. CARLSON SCHOOL OF MANAGEMENT, UNIVERSITY OF MINNESOTA are announcing the availability of Chair in Accounting. Applications for position now being accepted for continued research productivity as a scholar, contributions to accounting literature, intellectual/research guidance to junior faculty and doctoral students, teaching in one or all of BSB, MBA, MBT, PhD. programs, creating research synergies within the department. Doctorate in Accounting/related fields and teaching/research record consistent with school's standards for Full Professor. Salary competitive. Submit resumé or nominations by November 30, 1988 to David A. Dittman, Department of Accounting, Carlson School of Management, University of Minnesota, Minneapolis, MN 55455.